

GPM Mission Overview

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Learning Objectives

- Understand the basics of remote sensing of precipitation
- Identify NASA satellites and sensors used for deriving precipitation
 - describe precipitation data available from these sensors
 - describe data used to track below and above normal precipitation



Presentation Outline

- Precipitation Remote Sensing
- NASA Precipitation Missions and Data
 - Global Precipitation Measurements (GPM) Mission and Tropical Rainfall Measuring Mission (TRMM)
- TRMM and GPM Data Products
- TRMM/GPM Data Access and Visualization
 - Demonstration Precipitation Processing System – STORM
 - Demonstration of Giovanni

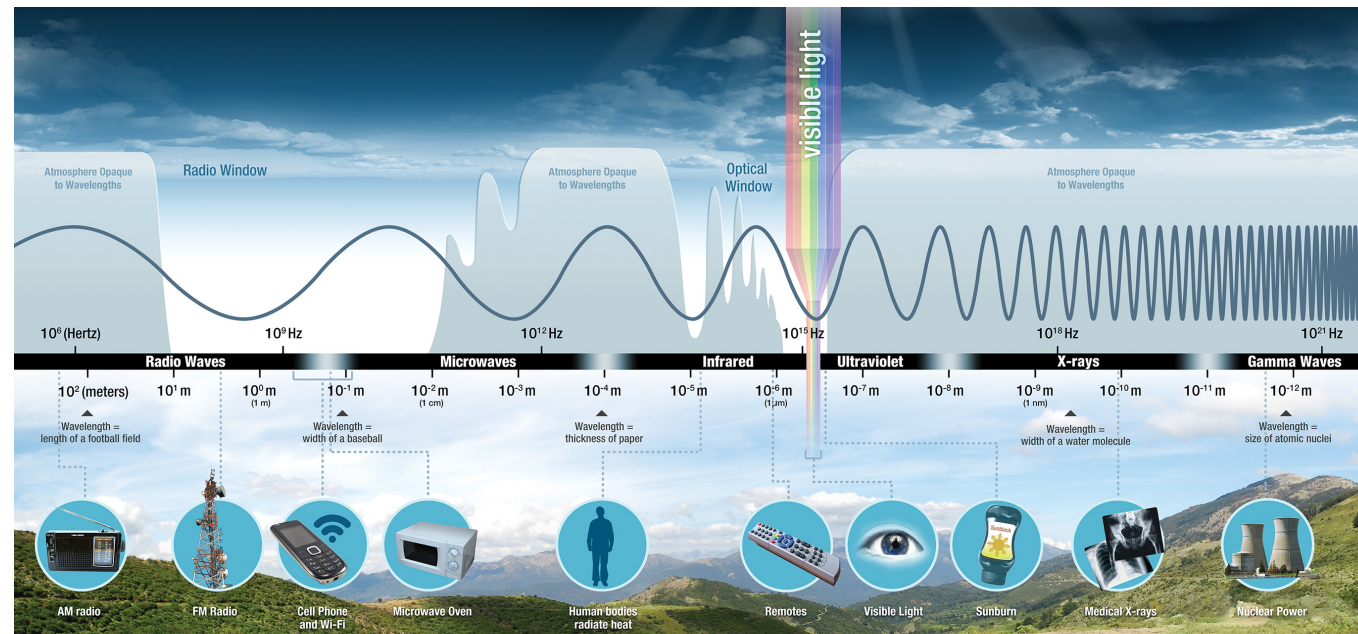




Precipitation Remote Sensing

Spectral Bands Used for Precipitation Remote Sensing

- Derived from:
 - reflected visible radiation (0.5 to 0.6 micrometer wavelength)
 - emitted infrared radiation (10-12 micrometer wavelength)
 - emitted microwave radiation (10 to 183 GHz frequency or mm to cm wavelength)



Precipitation Remote Sensing

Passive Remote Sensing: Inferred indirectly from emitted infrared (IR) radiation by clouds

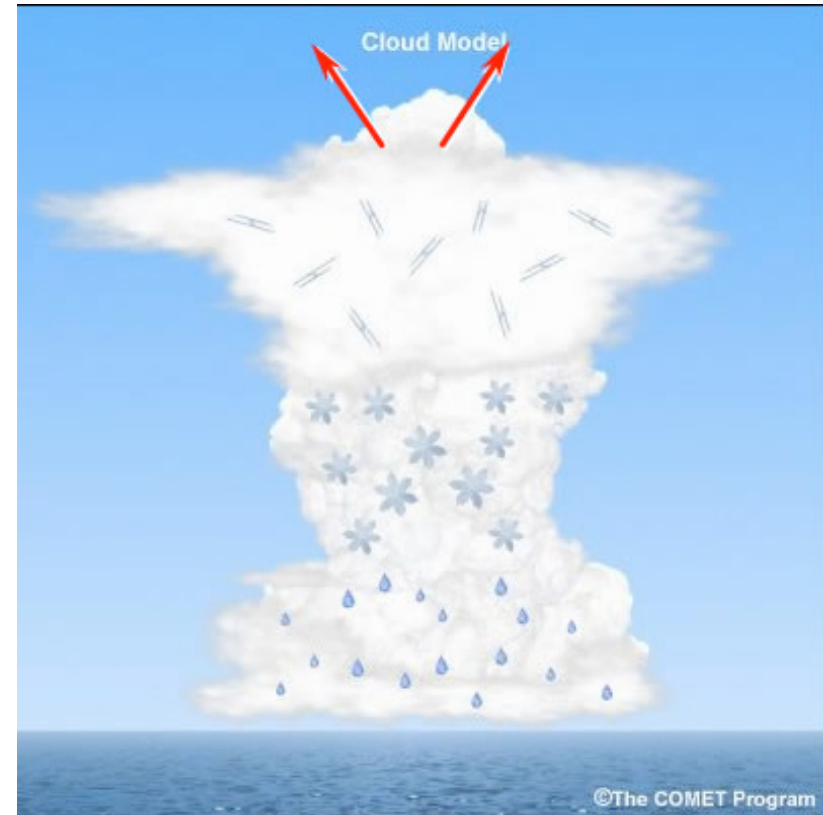
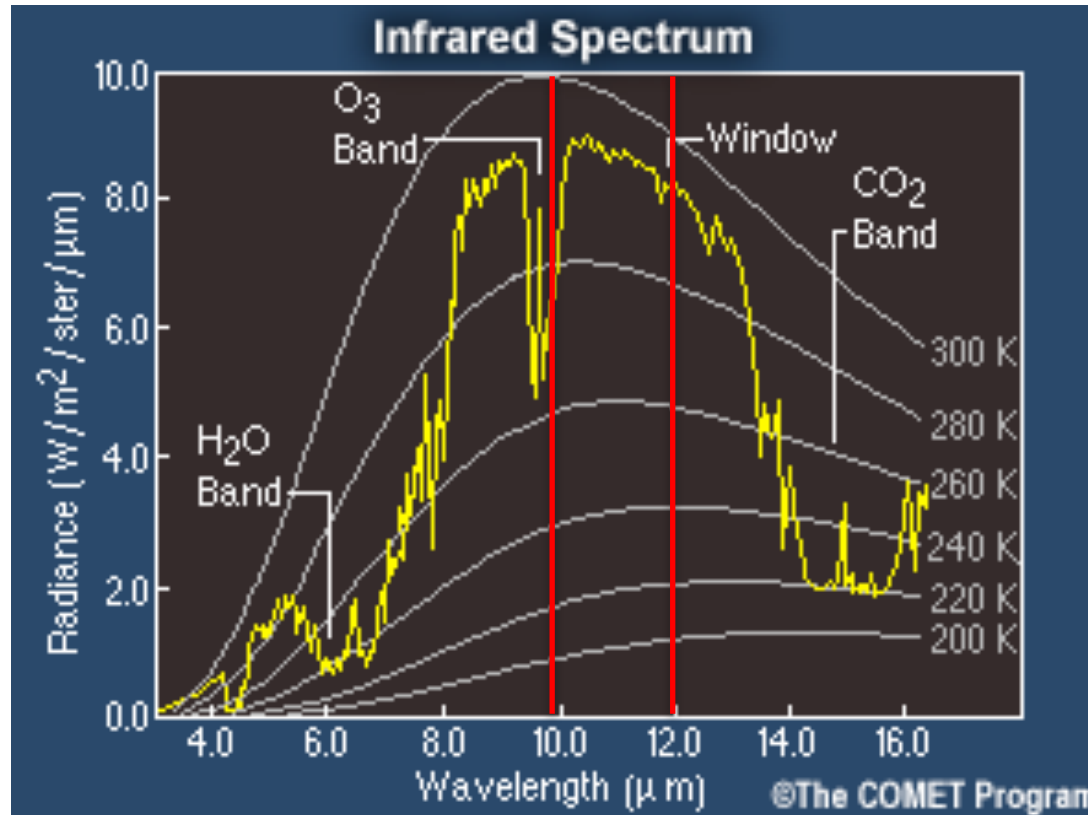
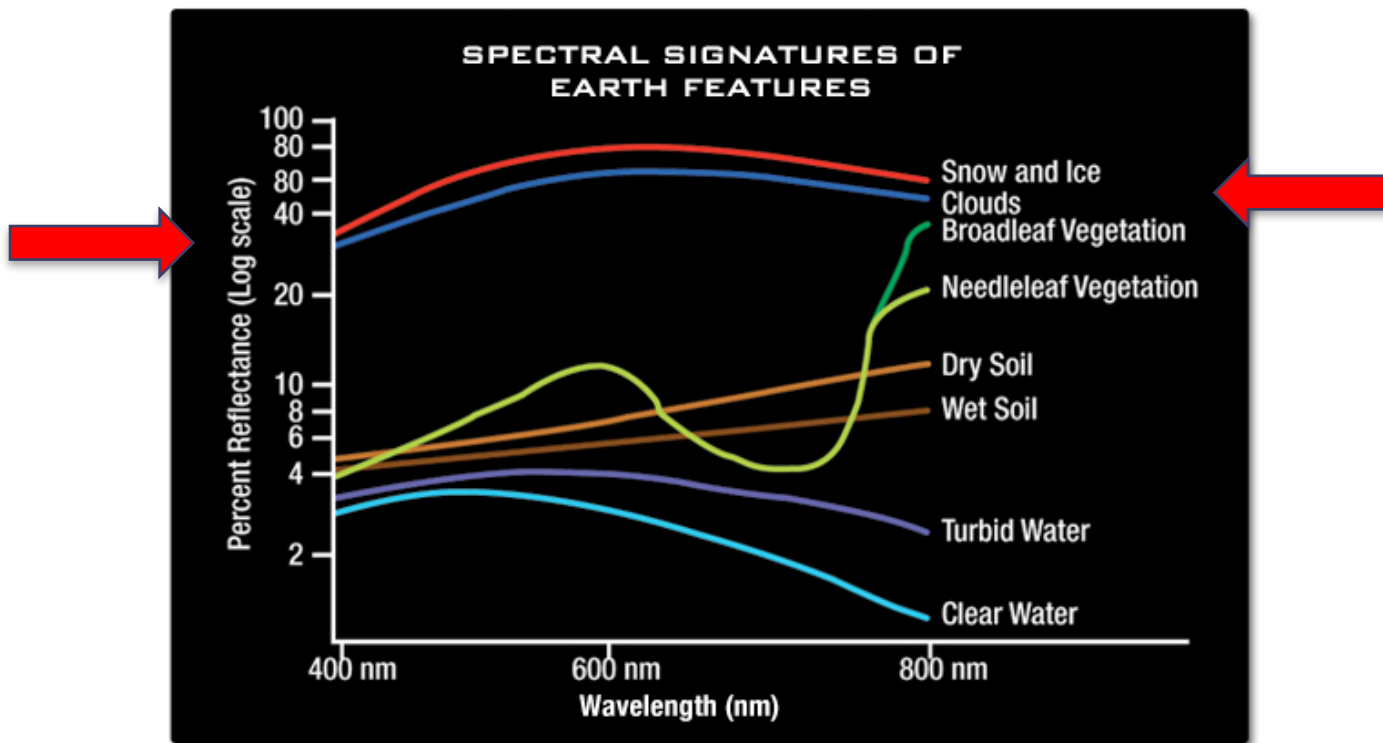


Image Credit (Left): UCAR COMET, comet.ucar.edu



Precipitation Remote Sensing

Passive Remote Sensing: Inferred indirectly from reflected solar visible (VIS) radiation by clouds

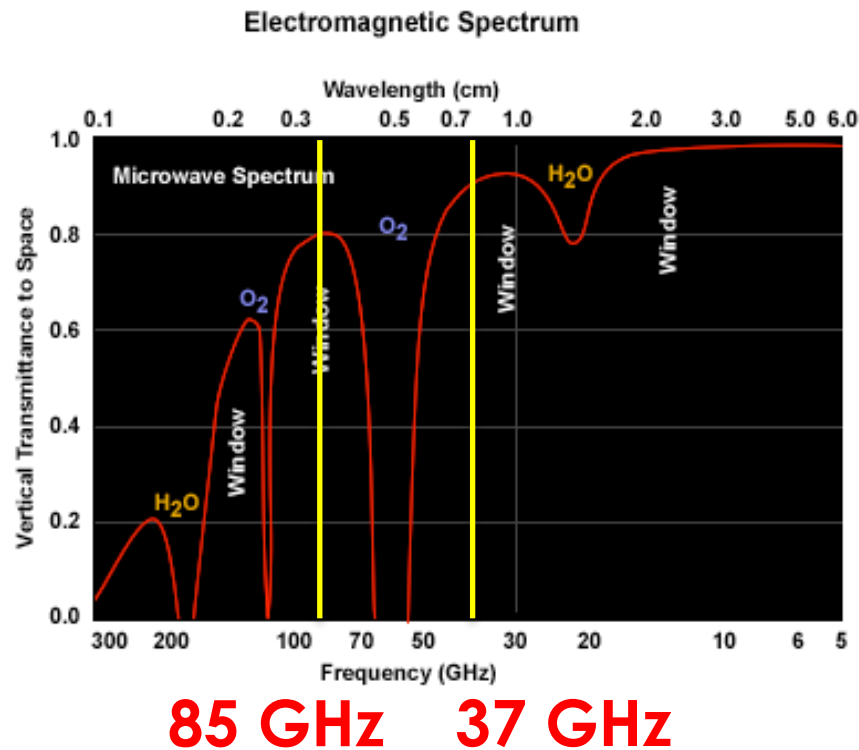


Passive | Sensors detect only what is emitted from the landscape, or reflected from another source (e.g., light reflected from the sun).

Image Credit (Left): UCAR COMET, comet.ucar.edu

Precipitation Remote Sensing

Passive Remote Sensing: Estimated from microwave radiation emitted or scattered by precipitation particles



- The lower frequencies, referred to as “emissions channels,” measure precipitation mainly from energy emitted by raindrops (37 GHz)
- The higher frequencies, or “scattering channels,” gather energy scattered by ice particles above the freezing level (85 GHz)

Image Credit (Left): UCAR COMET, comet.ucar.edu

Precipitation Remote Sensing

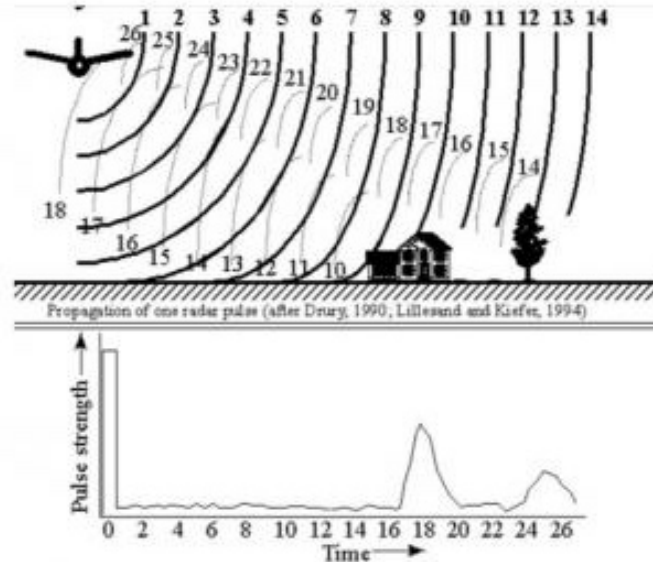
Active Remote Sensing: Estimated from back-scattered microwave radiation transmitted by radars



Active | Instruments emit their own signal and the sensor measures what is reflected back. Sonar and radar are examples of active sensors.

Active Remote Sensing

Source: Instrument pulse,
Needs power to operate



- NASA Satellites TRMM and GPM use K-band radar
- K-band generally has a frequency range within 27-40 GHz and 12-18 GHz

Image Credit: Paul Messina, Hunter College



NASA Precipitation Missions and Data

GPM and TRMM

<http://pmm.nasa.gov/>

Dedicated Missions to measure rainfall from active and passive microwave observations:

- Predecessor to Global Precipitation Measurement (GPM) Mission
- Tropical Rainfall Measurement Mission (TRMM)*

*TRMM is no longer available, but very important for long-term rainfall data

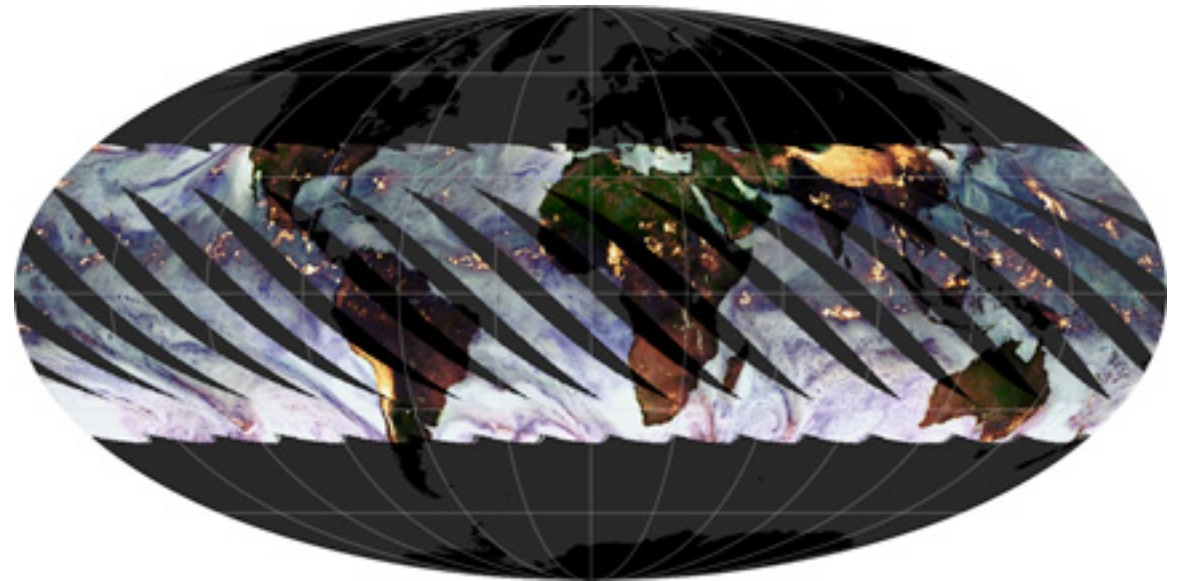


TRMM Sensors

<http://trmm.gsfc.nasa.gov/>

- In a non-polar, low-inclination orbit
- Altitude of approximately 350 km, raised to 403 km after August 23, 2001
- Spatial Coverage
 - 16 TRMM orbits a day covering global tropics between 35°S – 35°N latitude

TRMM Orbits

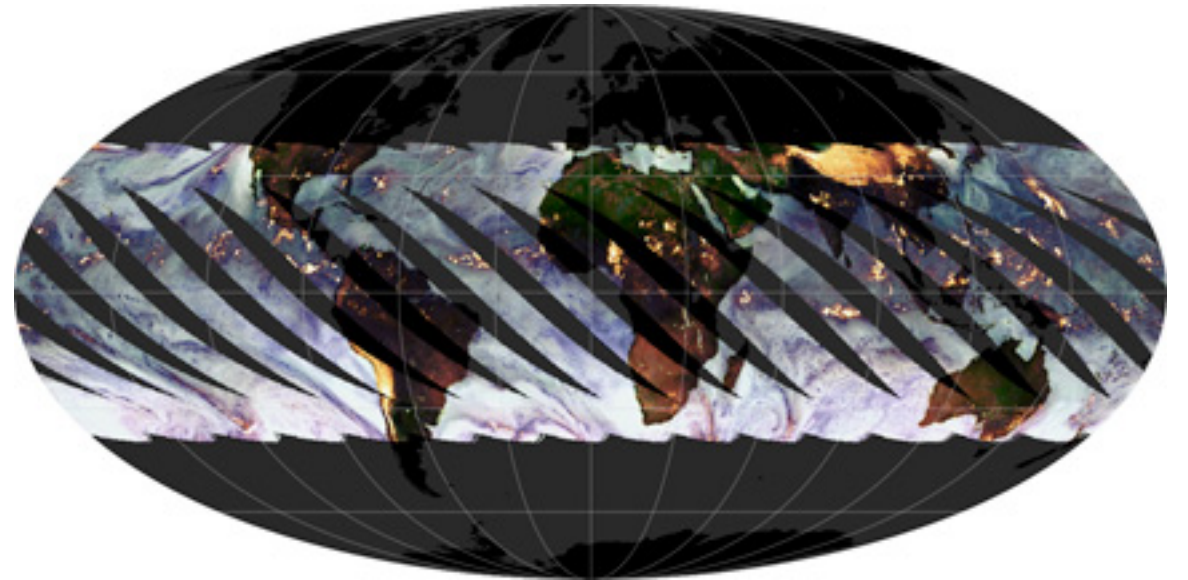


TRMM Sensors

<http://trmm.gsfc.nasa.gov/>

- Sensors:
 - TRMM Microwave Imager (TMI)
 - Precipitation Radar (PR)
 - Visible and Infrared Scanner (VIRS)
 - Lightning Imaging Sensor (LIS)
 - Clouds and the Earth's Radiant Energy System (CERES)

TRMM Orbits

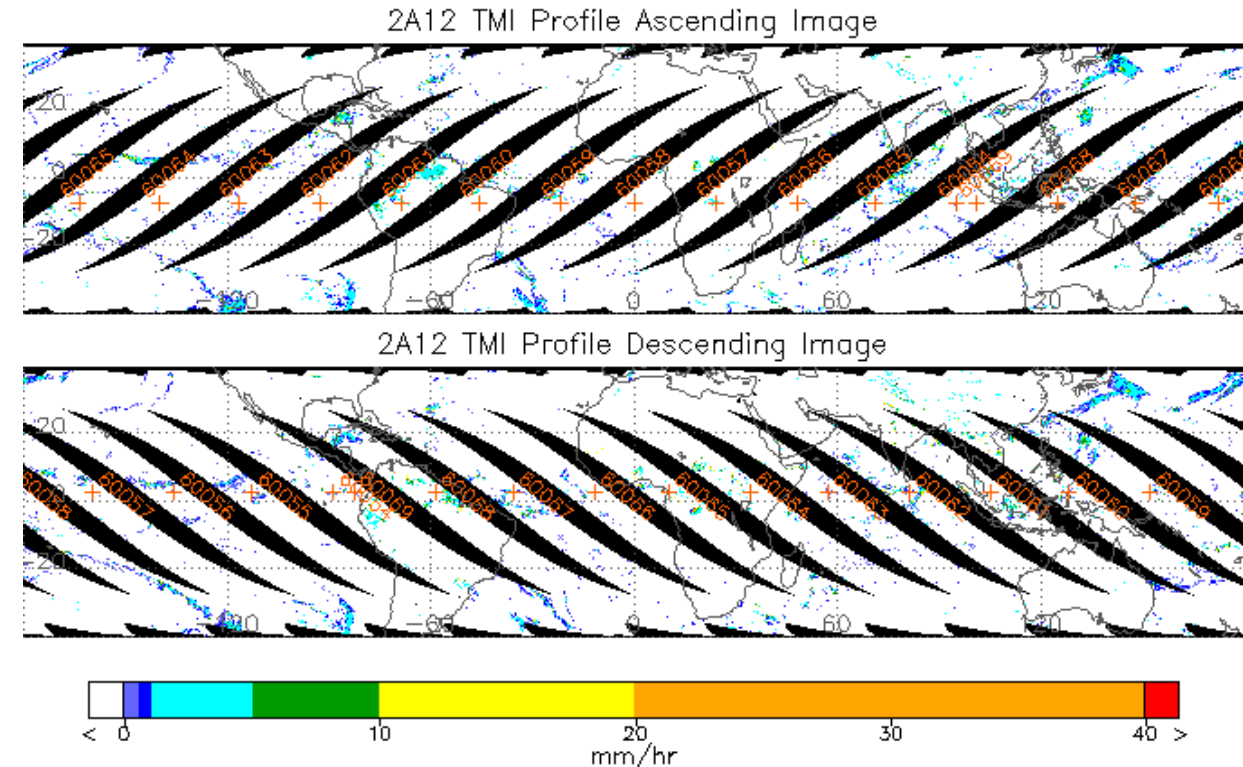


TRMM Microwave Imager (TMI)

<http://pmm.nasa.gov/TRMM/TMI>

- Spatial Coverage and Resolution:
 - Coverage: -180° – 180° , 35°S – 35°N
 - Swath: 760 km (878 km after 8/2001)
 - Vertical Resolution:
 - 0.5 km from surface – 4 km
 - 1.0 km from 4-6 km
 - 2.0 km from 6-10 km
 - 4.0 km from 10-18 km

TMI Swaths



2008/05/31 image contains 16 orbits, orbit numbers from 60054 to 60069

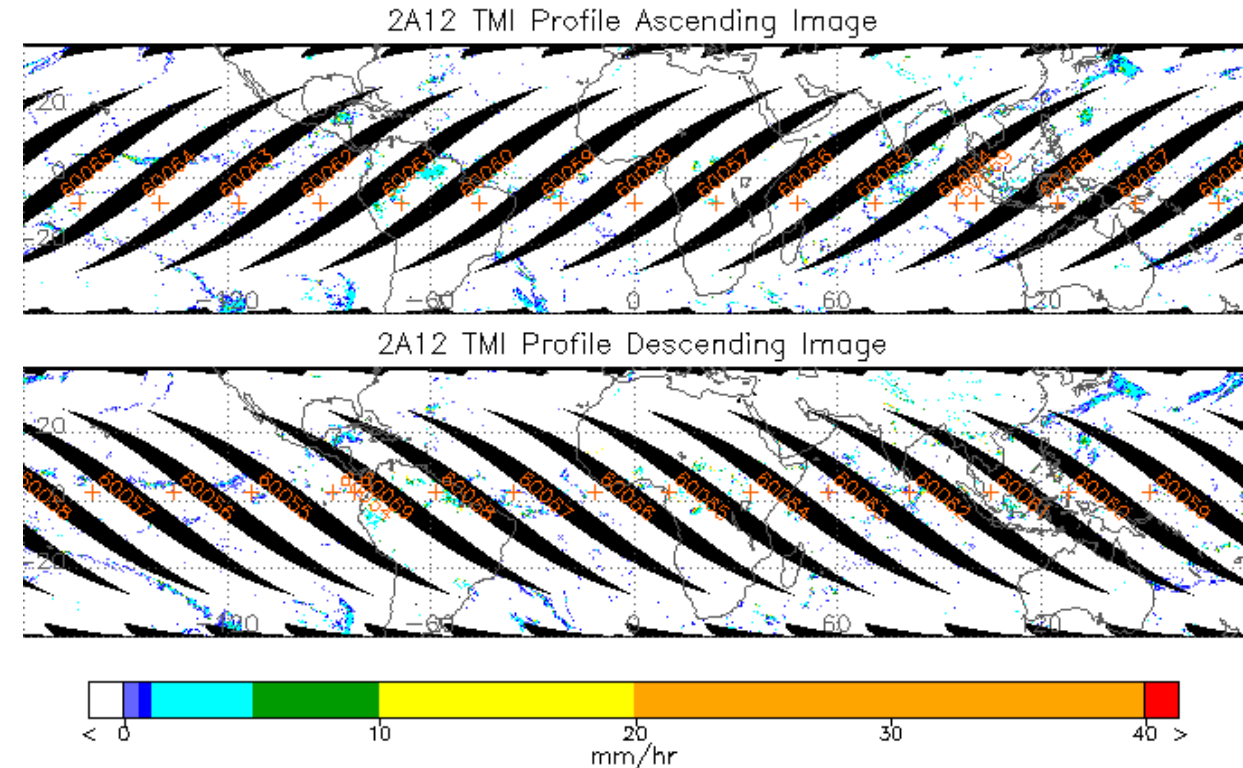


TRMM Microwave Imager (TMI)

<http://pmm.nasa.gov/TRMM/TMI>

- Temporal Coverage and Resolution:
 - November 27, 1998 - April 15, 2014
 - 16 orbits per day
- Channel Frequencies
 - 10.7, 19.4, 21.3, 37, 85.5 GHz

TMI Swaths



2008/05/31 image contains 16 orbits, orbit numbers from 60054 to 60069

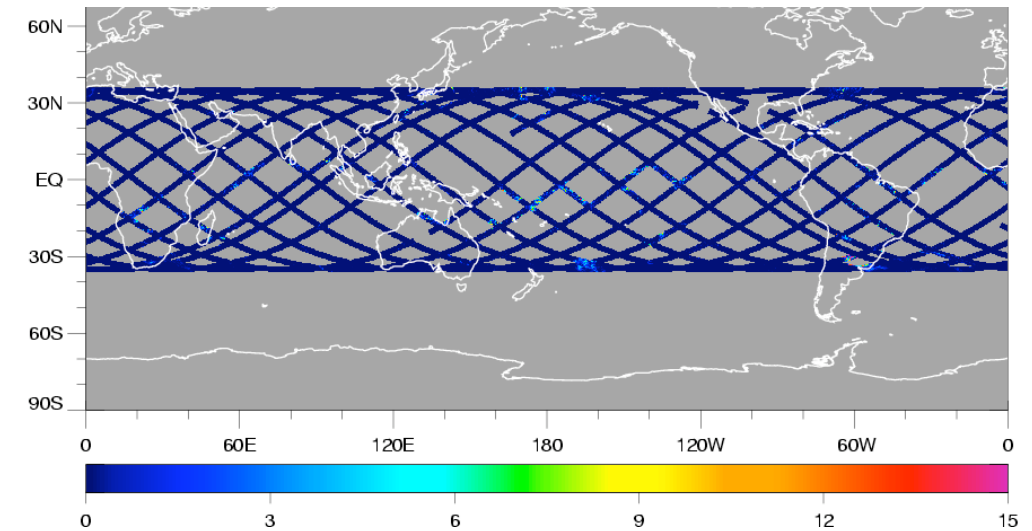


Precipitation Radar (PR)

<http://pmm.nasa.gov/TRMM/PR/>

- Spatial Coverage and Resolution:
 - Coverage: 35°S – 35°N
 - Swath: 215 km (247 after 8/2001)
 - Spatial Resolution: 4.3 km (5 km)
 - Vertical Resolution: 250 m (from 0-20 km)
- Temporal Coverage and Resolution:
 - November 27, 1998 – October 7, 2014
 - ~16 orbits per day
- Frequency:
 - 13.6 GHz

PR Swaths



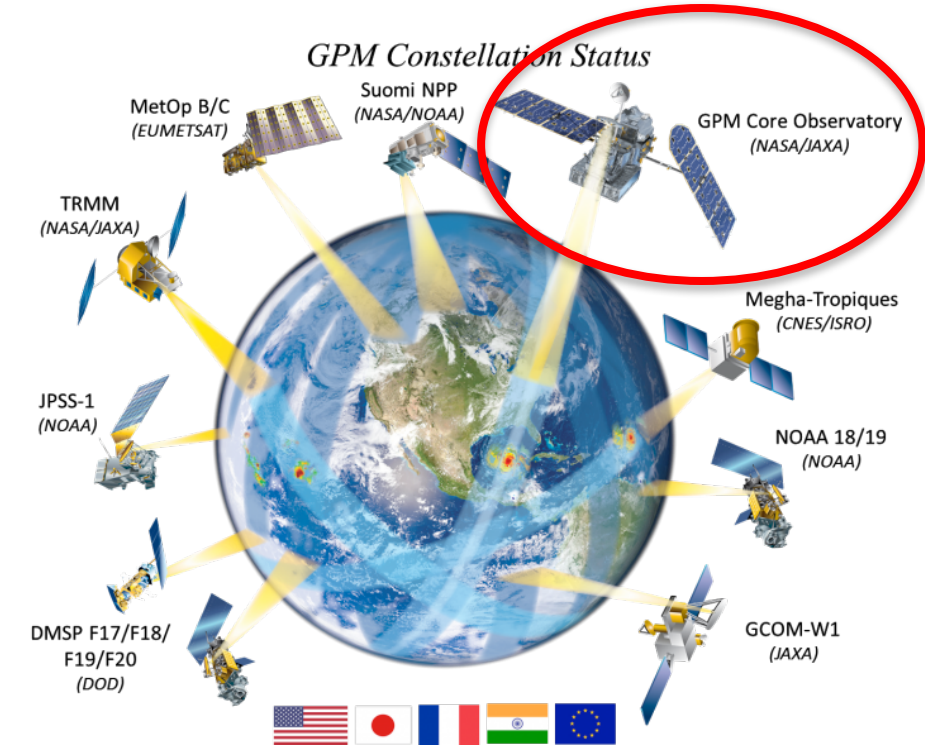
Kummerow, C., et. al, 1998: The tropical rainfall measuring mission (TRMM) sensor package, J. Atmos. Oceanic Technol., 15, 809-817.



GPM Satellite & Sensors

<http://pmm.nasa.gov/GPM/>

- Core satellite launched Feb 27, 2014
 - in a non-polar, low inclination orbit
 - Altitude: 407 km
- Spatial Coverage
 - 16 day orbits a day, covering global area between 65°S – 65°N
- Along with constellation of satellites, GPM has a revisit time of 2-4 hrs over land
- Sensors
 - GMI (GPM Microwave Imager)
 - DPR (Dual Precipitation Radar)

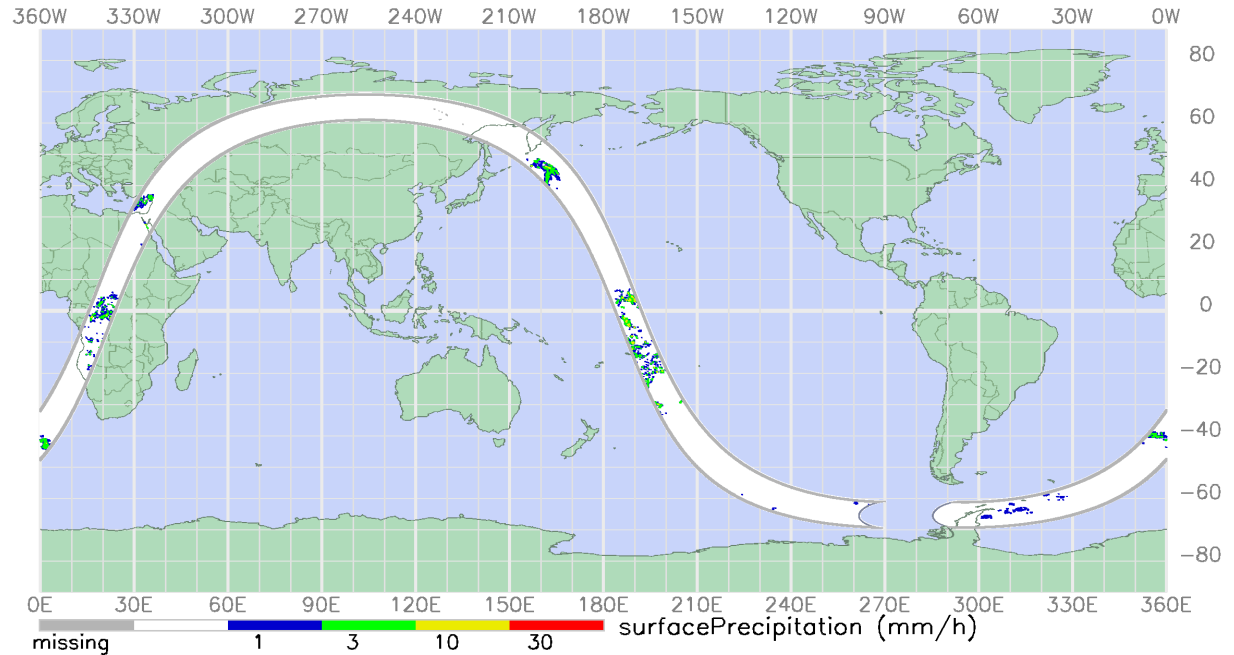


GPM Microwave Imager (GMI)

<http://pmm.nasa.gov/GPM/flight-project/GMI/>

- Spatial Coverage and Resolution:
 - Coverage: -180° - 180° , 65° S - 65° N
 - Swath: 885 km
- Spatial Resolution: 4.4-32 km
- Vertical Resolution:
 - 0.5 km from surface – 4 km
 - 1.0 km from 4-6 km
 - 2.0 km from 6-10 km
 - 4.0 km from 10-18 km

GMI Swath

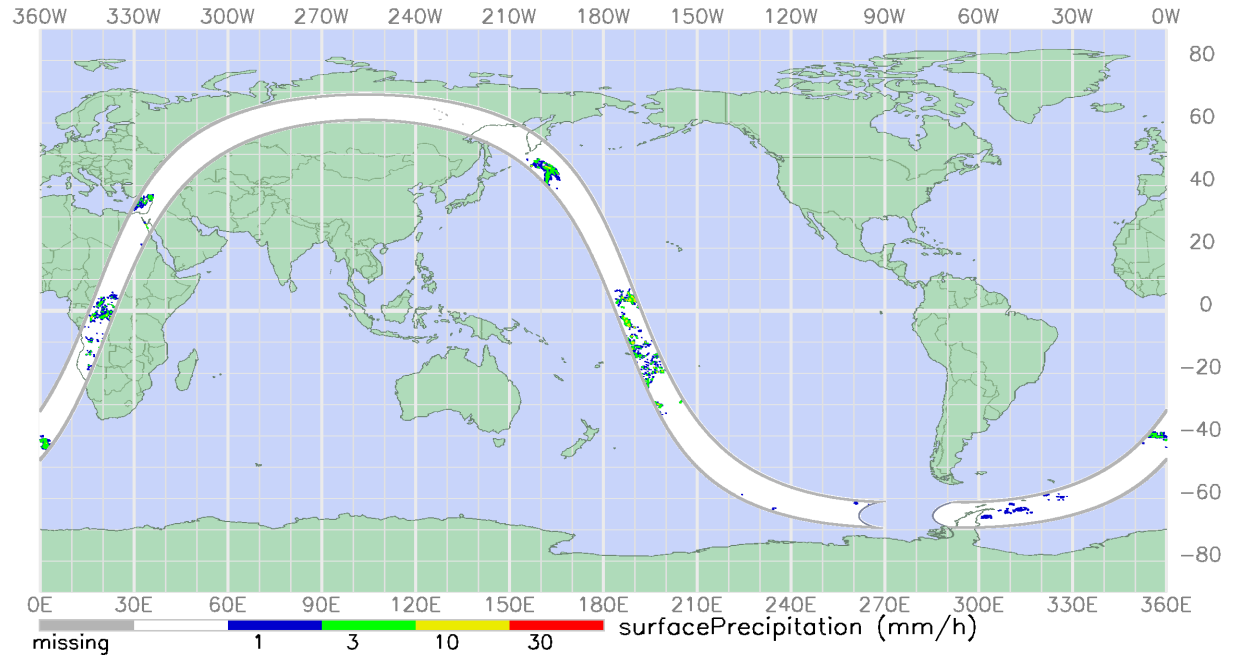


GPM Microwave Imager (GMI)

<http://pmm.nasa.gov/GPM/flight-project/GMI/>

- Temporal Coverage and Resolution
 - Feb 2014 – present, ~2-4 hr observations
- Channel Frequencies
 - 10.6, 18.7, 23.8, 36.5, 89, 166, 183 GHz

GMI Swath



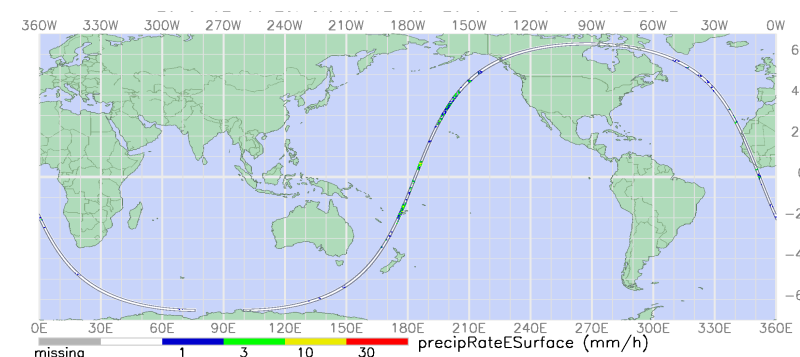
Dual Precipitation Radar (DPR)

<http://pmm.nasa.gov/GPM/flight-project/DPR/>

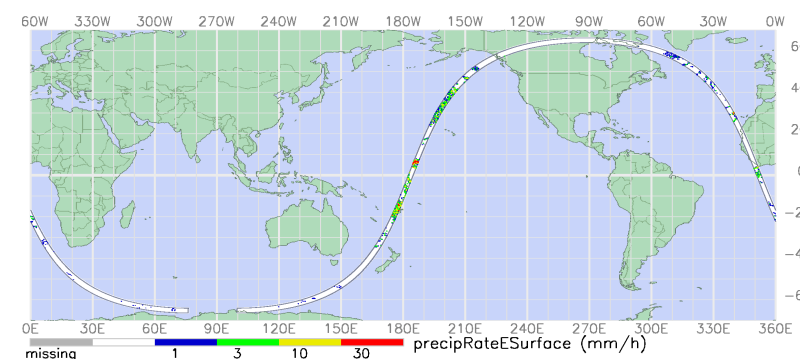
- Spatial Coverage and Resolution:
 - Coverage: -180° - 180° , 65° S- 65° N
 - Swath: 120km (Ka) and 245km (Ku)
 - Spatial Resolution: 5.2km
 - Vertical Resolution: 250m (from 0-20km)
- Temporal Coverage and Resolution:
 - Feb 27, 2014 – present
 - ~2-4 hr observations
- Frequency:
 - 13.6 and 35.5 GHz

DPR Swaths

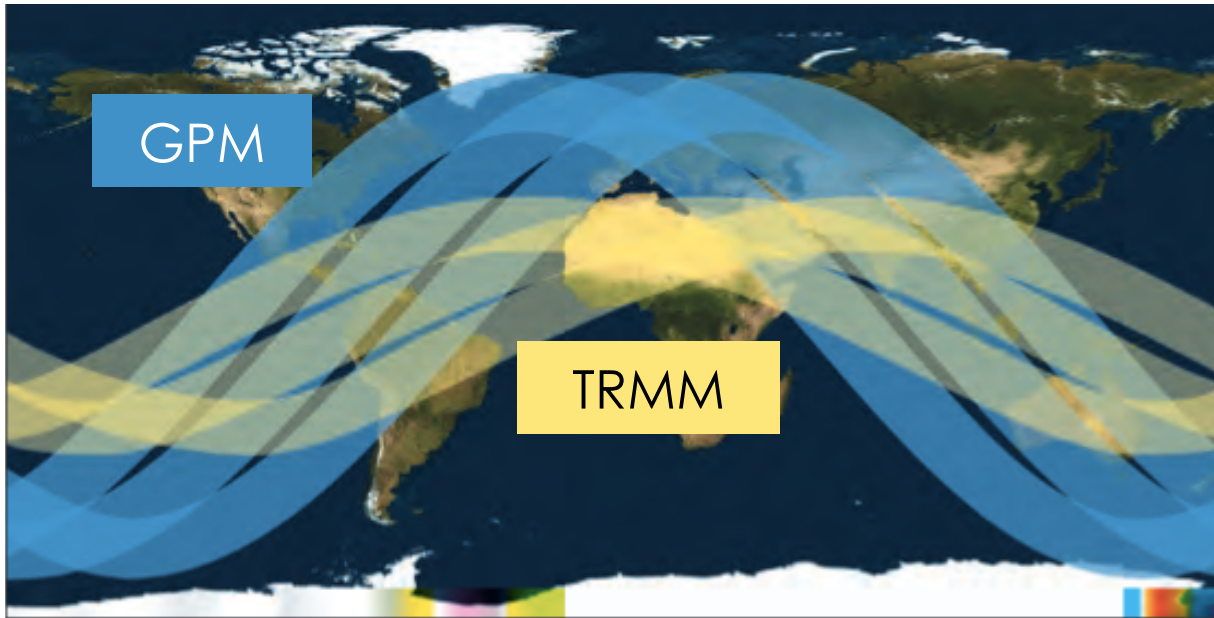
Ka 35.5 GHz



Ku 13.6 GHz



TRMM and GPM Comparison



- TRMM measurements are limited to the tropics
- GPM measurements span middle and high latitudes

- GMI & DPR
 - provide improved reference standards for inter-calibration of constellation precipitation measurements
 - better accuracy measurements
- GMI has a higher spatial resolution than TMI
- Improved light rain and snow detection in GMP
- DPR has better identification of liquid, ice, mixed-phase precipitation particles



Importance of TRMM Data Products

- TRMM provided high resolution precipitation data for 17 years
 - Useful for detecting and understanding climate variability and change
- Many applications are developed from TRMM data and still have to transition to using GPM data
 - extreme rain, flood, and drought monitoring and mapping
 - agriculture
 - Health

TRMM and GPM data will be inter-calibrated to provide a combined long-term precipitation record in 2018



Precipitation Algorithms for TRMM and GPM

<http://pmm.nasa.gov/science/precipitation-algorithms>

There are four major algorithms used to obtain precipitation estimates from GPM/TRMM observations:

1. Radar Algorithms
2. Radiometer Algorithms
3. Combined Radar + Radiometer Algorithms
4. Multi-Satellite Algorithms
 - TRMM and GPM Core are used as calibrators for multiple national and international constellation satellites



Summary of TRMM Level-2 Precipitation Products

Sensor or Product Name	Spatial Resolution & Coverage	Temporal Resolution	Data Format
PR only: 2A25	<ul style="list-style-type: none"> • 5 km x 5 km • Single orbit • 16 orbits/day (35°S–35°N) 	<ul style="list-style-type: none"> • 7-day latency for near real-time • 3-hour, 2-day, 5-day 	HDF4
TMI only: 2A12	<ul style="list-style-type: none"> • 5 km x 5km • Orbital • 16 orbits/day (38°S–38°N) 	<ul style="list-style-type: none"> • 3-hour, 2-day, 15-day 	
Combined TMI & PR: 2B31	<ul style="list-style-type: none"> • 5 km x 5 km • Orbital • 16 orbits/day (38°S–38°N) 	<ul style="list-style-type: none"> • 7-day latency for near real-time • 3-hour, 2-day, 5-day 	



Summary of TRMM Level-3 Precipitation Products

Sensor or Product Name	Spatial Resolution & Coverage	Temporal Resolution	Data Format
TMPA: 3B42RT & Final 3B42	<ul style="list-style-type: none"> • $0.25^{\circ} \times 0.25^{\circ}$ • $50^{\circ}\text{S} \times 50^{\circ}\text{N}$ 	<ul style="list-style-type: none"> • RT is NRT with 8 hr latency • 3-hourly 	<ul style="list-style-type: none"> • RT data in binary and OpenDAP
TMPA: 3B43		<ul style="list-style-type: none"> • Monthly • 2 month latency 	<ul style="list-style-type: none"> • HDF4 • NetCDF
PR only: 3A12	<ul style="list-style-type: none"> • $0.5^{\circ} \times 0.5^{\circ}$ and $5^{\circ} \times 5^{\circ}$ • $37^{\circ}\text{S} \times 37^{\circ}\text{N}$ 	<ul style="list-style-type: none"> • Monthly 	<ul style="list-style-type: none"> • HDF4 • OpenDAP
TMI only: 3A12	<ul style="list-style-type: none"> • $0.5^{\circ} \times 0.5^{\circ}$ • $38^{\circ}\text{S} \times 38^{\circ}\text{N}$ 	<ul style="list-style-type: none"> • Monthly 	
TMI-PR Combined: 3B31	<ul style="list-style-type: none"> • $5^{\circ} \times 5^{\circ}$ • $40^{\circ}\text{S} \times 40^{\circ}\text{N}$ 	<ul style="list-style-type: none"> • Monthly 	



Summary of GPM Level-2 Precipitation Products

Sensor or Product Name	Spatial Resolution & Coverage	Temporal Resolution	Data Format
DPR Ku-only: 2A-Ku	<ul style="list-style-type: none"> • 5.2 km x 125 m • Single orbit • 16 orbits/day (70°S-70°N) 	<ul style="list-style-type: none"> • 20-120 minutes • 24 hrs 	<ul style="list-style-type: none"> • HDF5 • OpenDAP
DPR Ka-only: 2A-Ka			
DPR Ku & Ka: 2A-DPR			
GMI/2A-GPROF	<ul style="list-style-type: none"> • 4 km x 4 km • Orbital • 16 orbits/day (70°S-70°N) 	<ul style="list-style-type: none"> • 2-40 hrs 	
Combined GMI+DPR:2A-CMB	<ul style="list-style-type: none"> • 5 km x 5 km • Orbital (70°S-70°N) • Coincident Ku-Ka GMI footprints 	<ul style="list-style-type: none"> • 3-40 hrs 	



Summary of GPM Level-3 Precipitation Products

Sensor or Product Name	Spatial Resolution & Coverage	Temporal Resolution	Data Format
IMERG	<ul style="list-style-type: none"> • 0.1°×0.1° • 90°S-90°N 	<ul style="list-style-type: none"> • 30 min (NRT) • 6 hr, 16 hr, & 3 month latency 	<ul style="list-style-type: none"> • HDF4 • NetCDF • OpenDAP • ASCII • .gif, .png • KML (Google Earth)
Combined GMI + DPR Rainfall Averages: 3-CMB	<ul style="list-style-type: none"> • 0.1°×0.1° • 70°S-70°N 	<ul style="list-style-type: none"> • Monthly 	
DPR Rainfall Averages: 3-DPR	<ul style="list-style-type: none"> • 0.25°×0.25° • 5.0°×5.0° • Daily: 67°S-67°N • Monthly: 70°S-70°N 	<ul style="list-style-type: none"> • Daily & Monthly 	
GMI Rainfall Averages: 3-GPROF	<ul style="list-style-type: none"> • 0.25°×0.25° • 90°S-90°N 	<ul style="list-style-type: none"> • Daily & Monthly 	



Multi-Satellite Algorithms for TRMM and GPM

<http://pmm.nasa.gov/science/precipitation-algorithms>

- TRMM & GPM core satellites are used to calibrate microwave observations from a constellation of national and international satellites
- Allow improved spatial and temporal coverage of precipitation data
- TRMM Multi-satellite Precipitation Analysis (**TMPA**)
- Widely used for applications
- TMPA will be extended to match Integrated Multi-satellitE Retrievals for GPM (**IMERG**)



TRMM Multi-satellite Precipitation Analysis (TMPA)

http://precip.gsfc.nasa.gov/trmm_comb.html

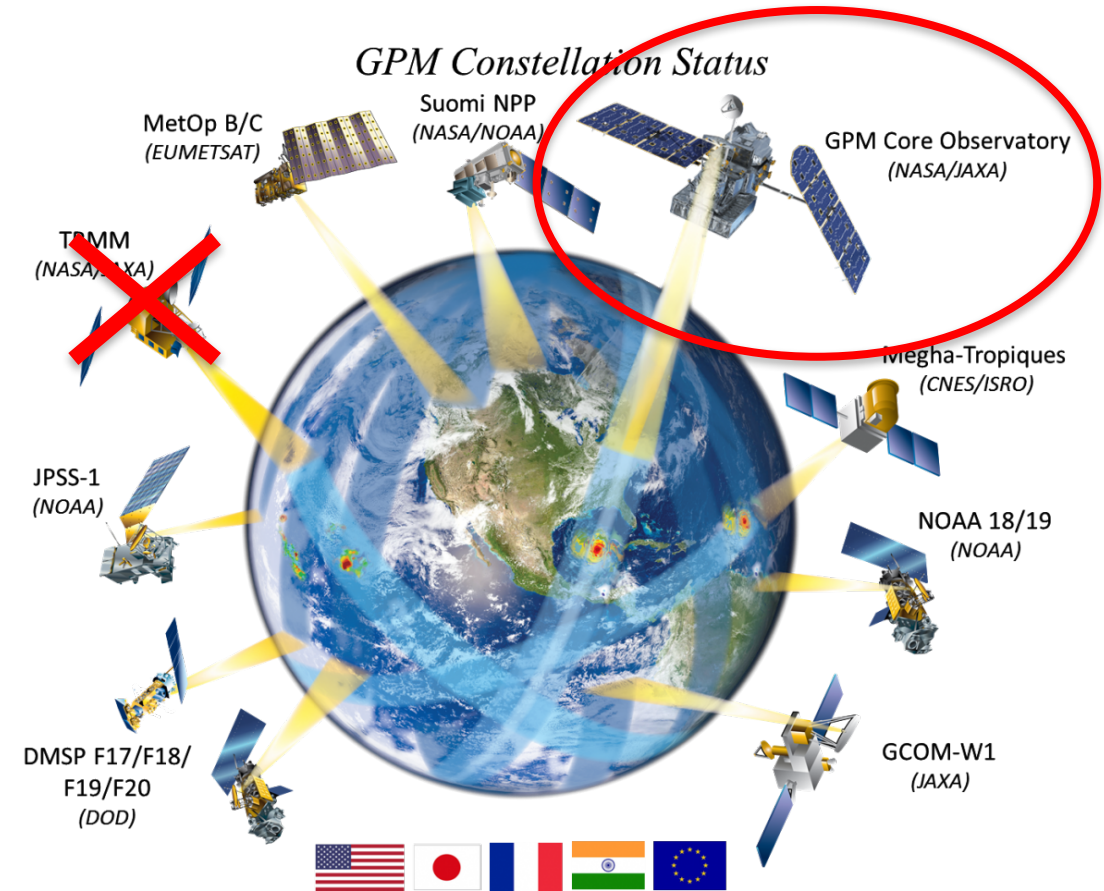
- TMPA combines PR & TMI rain rates
- Inter-calibrates passive rain rates from other satellite sensors
 - TMI, SSM/I (Special Sensor Microwave Imager), AMSR (Advanced Microwave Scanning Radiometer, Aqua), AMSU-B (Advanced Microwave Sounding Unit, NOAA), MHS (Microwave Humidity Sounder), IR radiometers*
- Inter-calibrates with national and international geostationary and NOAA low-earth orbiting satellites infrared measurements by using VIRS
- Final rain product is calibrated with rain gauge analyses on a monthly time scale



Integrated Multi-satellite Retrievals for GPM (IMERG)

http://pmm.nasa.gov/sites/default/files/document_files/IMERG_ATBD_V4.5.pdf

- Conceptually similar to TMPA
- GPM constellation satellites include:
 - GCOM-W
 - DMSP
 - Megha-Tropiques
 - MetOp-B
 - NOAA-N'
 - NPP
 - NPOESS
- Final rain product is calibrated with rain gauge analyses on monthly time scale



Integrated Multi-satellite Retrievals for GPM (IMERG)

http://pmm.nasa.gov/sites/default/files/document_files/IMERG_ATBD_V4.5.pdf

- **Multiple runs accommodate different user requirements for latency and accuracy**
 - “Early” – now 5 hours (flash flooding) – will be 4 hours
 - “Late” – now 15 hours (crop forecasting) – will be 12 hours
 - “Final” – 3 months (research data)
- **Native time intervals are half-hourly and monthly (final only)**
 - Value-added products at 3 hrs, 1, 3, and 7 days - .tiff will be available
 - Initial release covers 60°N-60°S – will be 90°N-90°S



TMPA and IMERG

	TMPA	IMERG
Spatial Resolution	0.25° x 0.25°	0.1° x 0.1°
Spatial Coverage	Global, 50° S – 50°N	Global, 60°S – 60°N (will be extended from pole to pole)
Temporal Resolution	3 hours	30 minutes
Temporal Coverage	12/1997 – present*	2/27/2014 – present ⁺

* After April 8, 2015, TRMM climatological calibration is being used to generate TMPA

⁺ TMPA and IMERG combined data will be available in early 2018 at IMERG data resolution



TRMM and GPM Data Type Convention

Learn More: <https://go.nasa.gov/2y7AouZ>

Type	Description
1A	Instrument count, geolocated, at instantaneous field of view (IFOV)
1B	Geolocated, calibrated T_b or radar power at IFOV
1C	Intercalibrated brightness temperatures T_c at IFOV
2A	Geolocated geophysical parameters at IFOV from a single instrument
2B	Geolocated geophysical parameters at IFOV from multiple instruments
3A	Space/Time averaged geophysical parameters from a single instrument
3B	Space/Time averaged geophysical parameters from multiple instruments
4	Combined satellite, ground, and/or model data

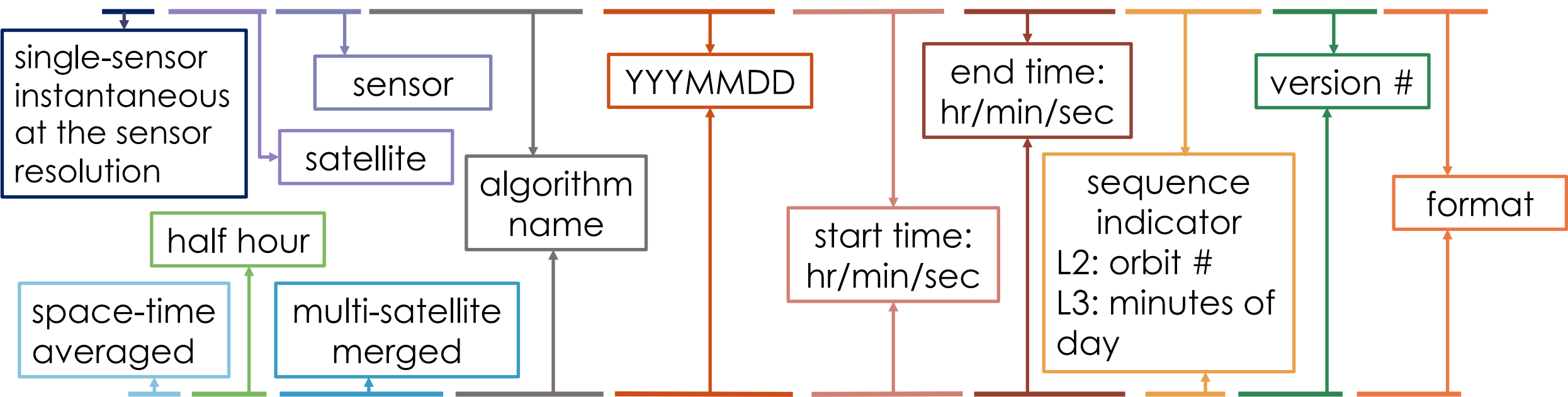


GPM File Name Convention

Learn More: <https://go.nasa.gov/2y7AouZ>

Level 2 File Name

2A.GPM.GMI.GPROF2008.20131101-S235152-E012400.000352.V03C.HDF5



3B-HHR.MS.MRG.3IMERG.20140805-S043000-E045959.0270.V03D.HDF5

Level 3 File Name



Trade-Offs Between Level 2 and Level 3 Precipitation Data Products

- IMERG and TMPA have lower spatial resolutions than Level 2 data
 - e.g. 2A12, 2A25, 2B31, 2A-GPROF, 2A-2DPR, 2BCMB
- IMERG and TMPA have better spatial coverage with no orbit gaps compared to Level 2 and Level 3 radar, imager, and radar/imager combined data
- IMERG and TMPA:
 - are uniformly gridded
 - have uniform temporal resolution to cover diurnal variations
 - are available in multiple formats
- Used for Monitoring above and Below Normal Precipitation
- Widely Used for Applications: Flooding, Droughts, Landslides, Agriculture, and Health





TRMM and GPM Data Access and Visualization

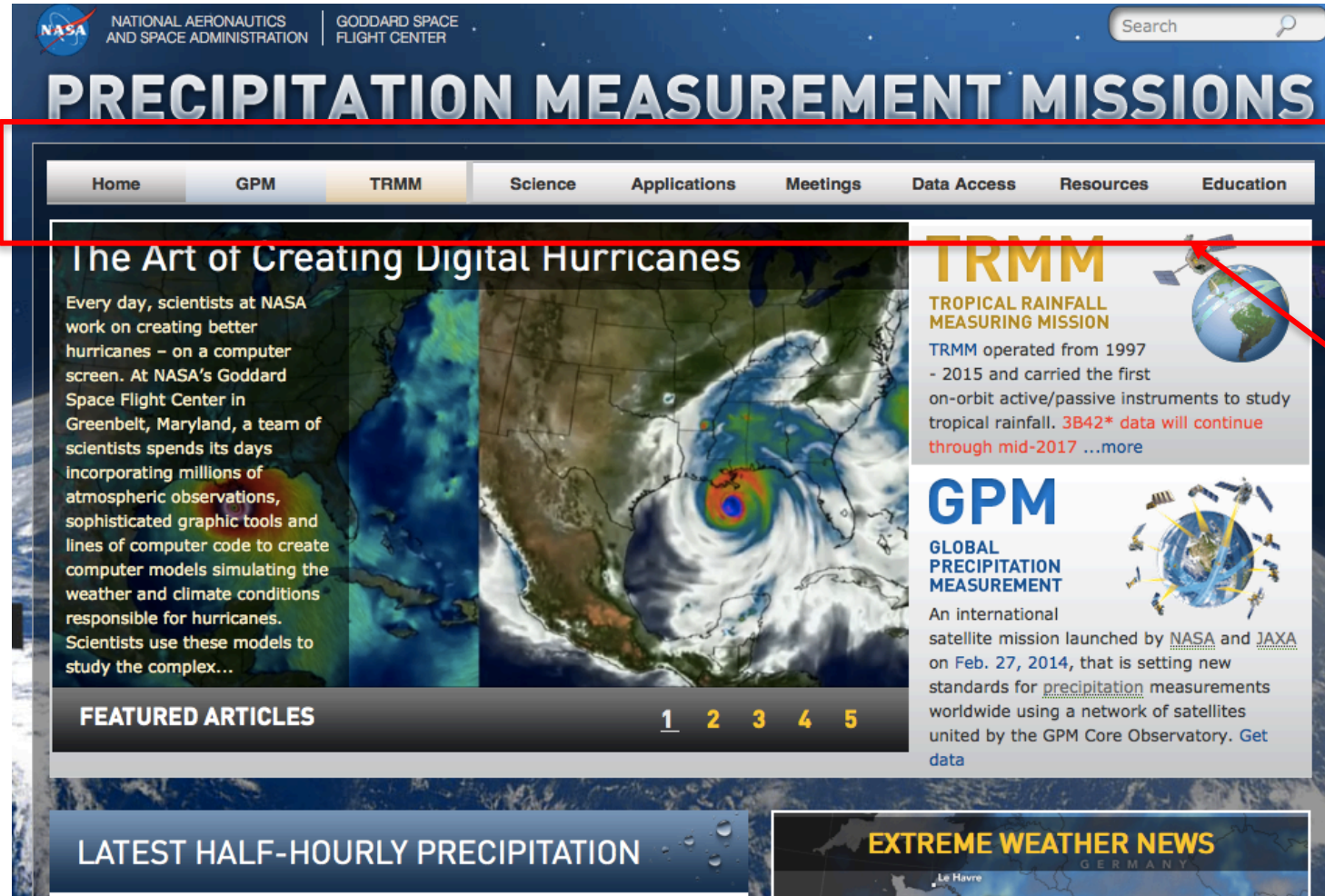
Precipitation Data Access Tools

Tool	Data & Format	Features
PPS/STORM http://storm.pps.eosdis.nasa.gov/	<ul style="list-style-type: none"> • Rain Rate (TRMM, GPM) • HDF, PNG 	<ul style="list-style-type: none"> • Orbital and Gridded Data Search • Spatial/Temporal Subsetting • Individual Data and FTP Batch Download • Images and Interactive Data Viewer
Giovanni http://giovanni.gsfc.nasa.gov/	<ul style="list-style-type: none"> • Rain Rate (TRMM, GPM) • NetCDF, GeoTIFF, PNG, KMZ, CSV (time series only) 	<ul style="list-style-type: none"> • Spatial/Temporal Subsetting • Analysis: <ul style="list-style-type: none"> • Time-averaged maps, animation, time series, scatter plots, map correlations, vertical profiles, time-averaged differences • Visualization: <ul style="list-style-type: none"> • Maps, time series, scatter plots, histograms • Near Real-Time Rain Rate Access



Precipitation Measurement Missions

<https://pmm.nasa.gov/>

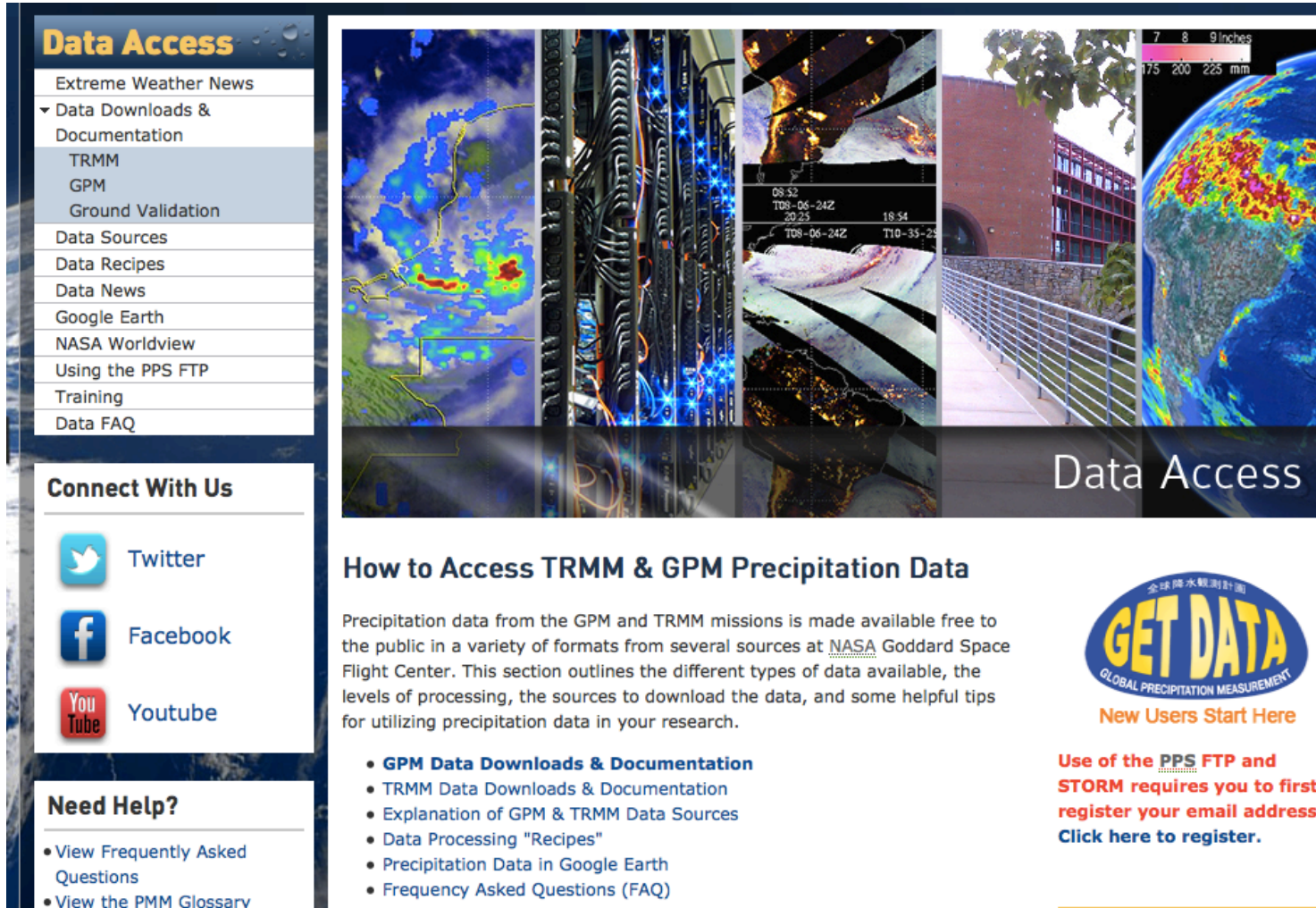


- Home of all information related to TRMM and GPM
- Links to data documentation and access



Precipitation Measurement Missions: Data Access

<https://pmm.nasa.gov/data-access>



Data Access

- Extreme Weather News
- ▼ Data Downloads & Documentation
 - TRMM
 - GPM
 - Ground Validation
- Data Sources
- Data Recipes
- Data News
- Google Earth
- NASA Worldview
- Using the PPS FTP
- Training
- Data FAQ

Connect With Us

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- Facebook
- Youtube

Need Help?

- View Frequently Asked Questions
- View the PMM Glossary

How to Access TRMM & GPM Precipitation Data

Precipitation data from the GPM and TRMM missions is made available free to the public in a variety of formats from several sources at [NASA](#) Goddard Space Flight Center. This section outlines the different types of data available, the levels of processing, the sources to download the data, and some helpful tips for utilizing precipitation data in your research.

- **GPM Data Downloads & Documentation**
- TRMM Data Downloads & Documentation
- Explanation of GPM & TRMM Data Sources
- Data Processing "Recipes"
- Precipitation Data in Google Earth
- Frequency Asked Questions (FAQ)

GET DATA
GLOBAL PRECIPITATION MEASUREMENT

New Users Start Here

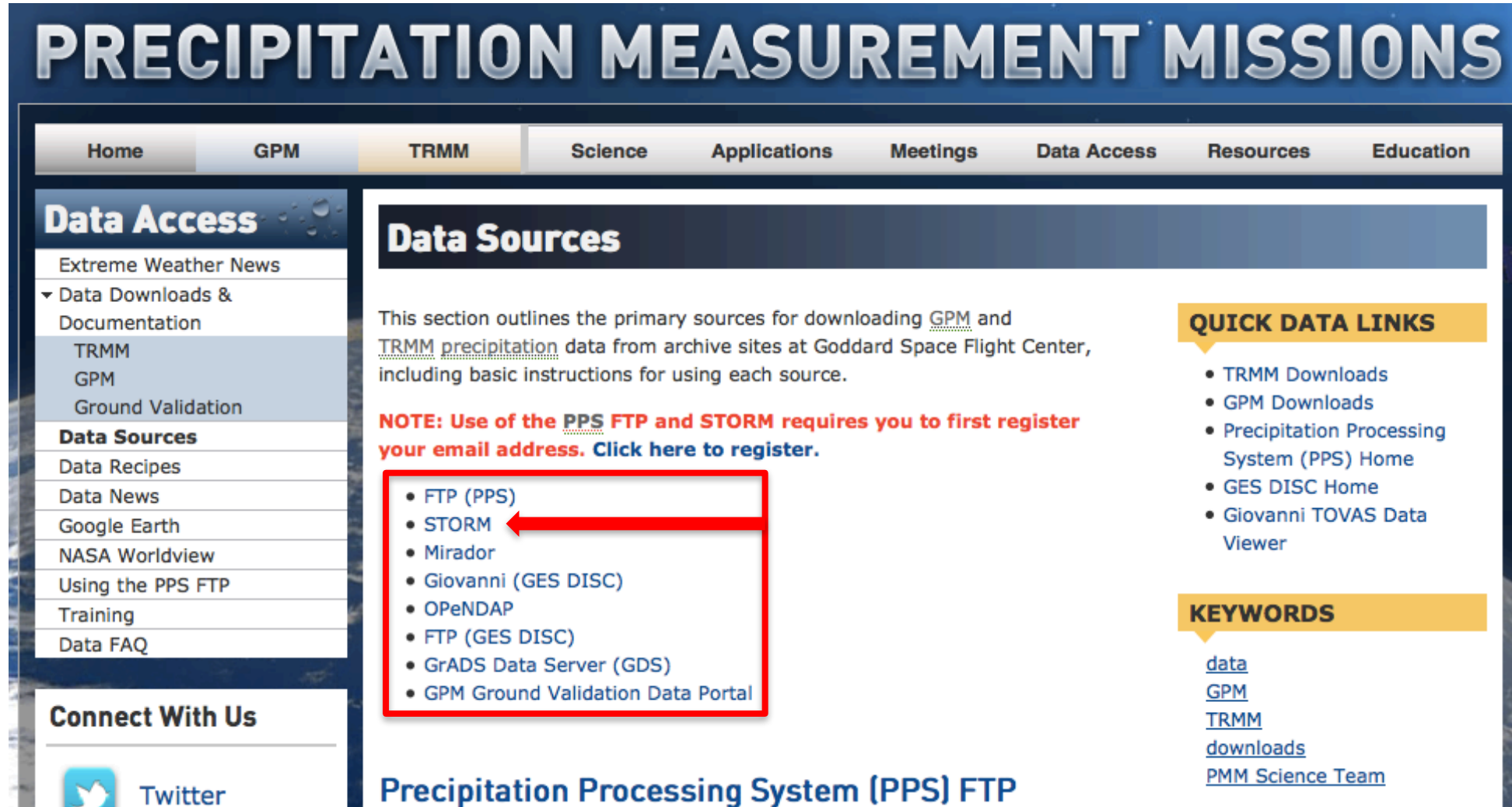
Use of the **PPS FTP** and **STORM** requires you to first register your email address. [Click here to register.](#)

- All about TRMM and GPM data
 - Including updates, news, and FAQ
- Quick data access links and user registration



Precipitation Measurement Missions: Data Sources

<http://pmm.nasa.gov/data-access/data-sources>



The screenshot shows the NASA Precipitation Measurement Missions (PMM) website. The main header is "PRECIPITATION MEASUREMENT MISSIONS". Below it is a navigation bar with links: Home, GPM, TRMM, Science, Applications, Meetings, Data Access, Resources, and Education. The "Data Access" section is highlighted. On the left, there is a sidebar with "Data Access" and "Data Sources" sections. The "Data Sources" section lists various data sources, with "STORM" highlighted by a red box and an arrow. The "Data Sources" section also includes a note about the PPS FTP and STORM requiring registration. On the right, there are "QUICK DATA LINKS" and "KEYWORDS" sections.


PRECIPITATION MEASUREMENT MISSIONS

Home GPM **TRMM** Science Applications Meetings Data Access Resources Education

Data Access

- Extreme Weather News
- ▼ Data Downloads & Documentation
 - TRMM
 - GPM
 - Ground Validation
- Data Sources**
- Data Recipes
- Data News
- Google Earth
- NASA Worldview
- Using the PPS FTP
- Training
- Data FAQ

Connect With Us

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Data Sources

This section outlines the primary sources for downloading GPM and TRMM precipitation data from archive sites at Goddard Space Flight Center, including basic instructions for using each source.

NOTE: Use of the PPS FTP and STORM requires you to first register your email address. [Click here to register.](#)

- FTP (PPS)
- **STORM**
- Mirador
- Giovanni (GES DISC)
- OPeNDAP
- FTP (GES DISC)
- GrADS Data Server (GDS)
- GPM Ground Validation Data Portal

QUICK DATA LINKS

- [TRMM Downloads](#)
- [GPM Downloads](#)
- [Precipitation Processing System \(PPS\) Home](#)
- [GES DISC Home](#)
- [Giovanni TOVAS Data Viewer](#)

KEYWORDS

[data](#)
[GPM](#)
[TRMM](#)
[downloads](#)
[PMM Science Team](#)

Precipitation Processing System (PPS) FTP





PPS & STORM

<http://storm.pps.eosdis.nasa.gov/storm>

Precipitation Processing System: STORM

<https://storm.pps.eosdis.nasa.gov/storm/>



[HOME](#)[DATA ACCESS](#)[TOOLS](#)[PRODUCT INFORMATION](#)[REGISTRATION](#)

Home

Need Help?

- STORM User Guide
- Help Desk

News

6/1/2016 - Parameter Categories are now available in STORM. Make faster parameter subsetting requests by using the preselected categories available in the dropdown at the top of the file tree interface. Let us know if you have any suggestions for other categories that would be useful.

5/13/2016 - STORM Virtual Globe (STORM VG) and an enhanced satellite-satellite coincidence map are now available to users.

PPS is currently undergoing transition from GPM V03 to V04. Certain products and orders may be delayed or temporarily unavailable during this period. For updates on transition progress, click [here](#). Update 6/16/16: PPS has begun reprocessing of V04A Level 2-3 GPROF SSMIS and AMSR2 climatology products. Reprocessing will start with March 1, 2014 data.

PPS Data Access - to search for GPM and TRMM data, order custom subsets and set up subscriptions.

PPS Public Archive - to access GPM and TRMM standard products via online ftp.

These are the products available to the public. To retrieve data go to [PPS Data Access](#) or [PPS Public Archive](#).


Data Type	Algorithm	Satellite	Instrument	Primary Content
1A	1A01	TRMM	VIRS	Counts
1A	1A11	TRMM	TMI	Counts
1A	1A21	TRMM	PR	Counts
1A	1AGMI	GPM	GMI	Counts
1B	1B01	TRMM	VIRS	Radiance
1B	1B11	TRMM	TMI	Brightness Temperature
1B	1B21	TRMM	PR	Radar Power
1B	1BGMI	GPM	GMI	Brightness Temperature
1B	1BKa	GPM	DPR_KA	Radar Power
1B	1BKu	GPM	DPR_KU	Radar Power
1C	1C21	TRMM	PR	Reflectivity
1C	1CAMSR2	GCOMW1	AMSR2	Brightness Temperature
1C	1CATMS	NPP	ATMS	Brightness Temperature

PPS

Precipitation Processing System (PPS)



Global Precipitation Measurement Mission (GPM)



Tropical Rainfall Measuring Mission (TRMM)

- All TRMM and GPM data products can be downloaded from STORM
- Data images and HDF5 data viewer are available in STORM

NASA's Applied Remote Sensing Training Program

42



Giovanni

<http://giovanni.gsfc.nasa.gov/>

Giovanni transition to https... [1 of 3 messages] [Read More](#)

Select Plot

☒ Maps: Time Averaged Map ▾

☐ Comparisons: *Select...* ▾

☐ Vertical: *Select...* ▾


☐ Time Series: *Select...* ▾

Analysis/Plot Options

Select Date Range (UTC)


YYYY-MM-DD.

HH:mm

- - 

00 : 00

to

- - 

23 : 59

Valid Range: 1948-01-01 to 2017-03-13

Select Region (Bounding Box or Shapefile)

Format: West, South, East, North

Show Map

Temporal & Spatial Search

Map & Shapefile selection for various countries or U.S. States

Select Variables

▼ Disciplines

- ☐ Aerosols (179)
- ☐ Atmospheric Chemistry (53)
- ☐ Atmospheric Dynamics (322)
- ☐ Cryosphere (15)
- ☐ Hydrology (1004)
- ☐ Ocean Biology (44)

Number of matching Variables: 0 of 1639

Total Variable(s) included in Plot: 0

Keyword :

Search

Clear

Search data by Keyword

Plot Data



Help

Reset

Feedback

Plot Data

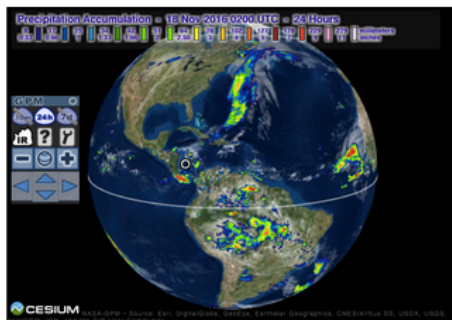
Demonstration: Data Visualization

<https://pmm.nasa.gov/data-access/visualization>

Data Visualization

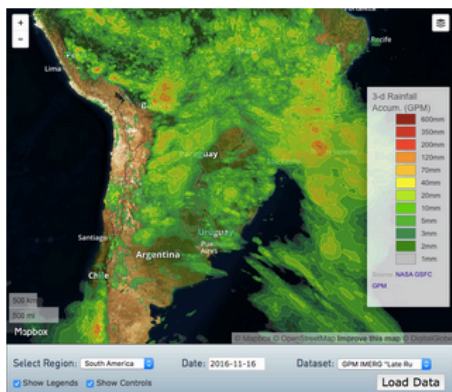
Global Viewer

View the latest near-real-time GPM IMERG global precipitation datasets (30 minute, 1 day, 7 day) on an interactive 3D globe in your web browser.



Precipitation and Applications Viewer

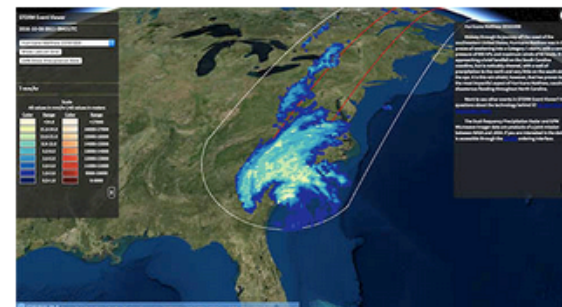
View and download various precipitation and applications datasets from the past 60 days (30 minute, 1 day, 3 day, 7 day precipitation, floods nowcast, landslides nowcast). Download datasets in various popular formats (TIF, SHP, arcJSON, geoJSON, topoJSON) and learn how to directly access the data via the PMM Publisher API.



STORM Event Viewer

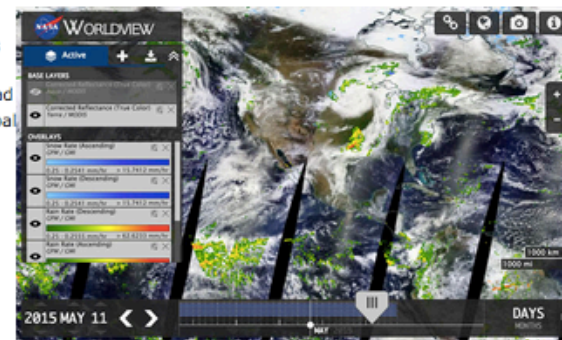
View 2D GMI and 3D DPR data from the latest extreme weather events on an interactive 3D globe in your web browser.

(click here for mobile version)



NASA Worldview

This tool from NASA's Earth Observing System Data and Information System (EOSDIS) provides the capability to interactively browse global, full-resolution satellite imagery and then download the underlying data, including data from the Global Precipitation Measurement Missions.





Demonstration of STORM and Giovanni

Questions for Discussion

1. What are the major differences between TRMM and GPM?
2. Why are TMPA and IMERG used the most in applications even though their spatial resolution is lower compared to TRMM and GPM sensor data (Level-2)?
3. Which data access tool is for bulk data download and not for analysis or visualization?





Next
Hands-on Exercise: Precipitation Data Access &
Analysis



Extra Slides: GPM Data Validation
From <https://pmm.nasa.gov/training>

GPM Data Product Validation

<http://pmm.nasa.gov/data-access/downloads/ground-validation/>

GPM precipitation data are currently being validated with a variety of field measurements

Ground Validation Data Downloads

Ground Validation Data

GPM Ground Validation Data Homepage: <http://gpm-gv.gsfc.nasa.gov/>

GPM Ground Validation Data Access: <https://ghrc.nsstc.nasa.gov/pub/fieldCampaigns/gpmValidation/>

The goal of this site is to provide a one-stop-shopping portal for accessing the various radar, disdrometer, gauge and other instrument data sets supporting GPM GV activities. Use the tabs above to access the various datasets, including:

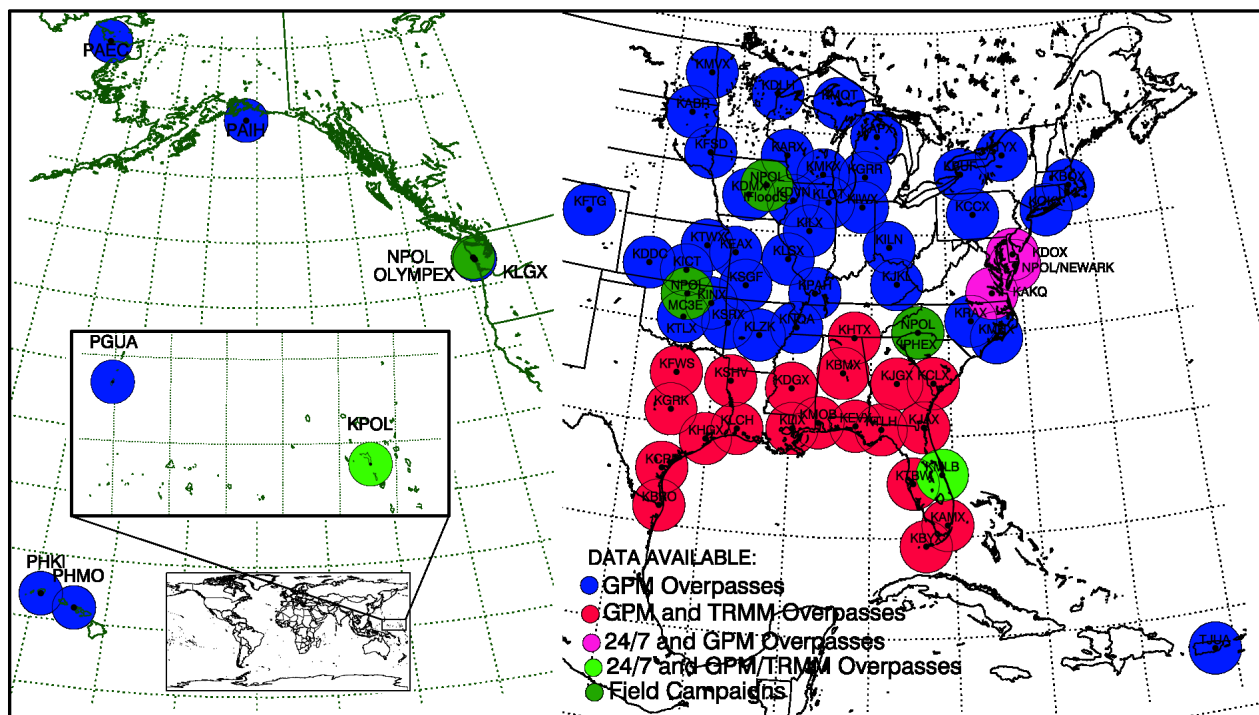
- [Radar](#)
- [Gauge](#)
- [Disdrometer](#)
- [NOAA/NMQ](#)
- [Field Campaigns](#)
- [Validation Network](#)
- [Wallops Precipitation Research Facility](#)



GPM Data Product Validation

<http://pmm.nasa.gov/data-access/downloads/ground-validation/>

GPM precipitation data are currently being validated with a variety of field measurements



TRMM and GPM Rain Gauge Data Archive



NASA, in support of first TRMM and now also GPM GV efforts has been collecting tipping bucket rain gauge data for over two decades. Early efforts used standalone tipping buckets with loggers that required manual downloads. In the GPM era, we are now able to use telemetered gauges using cell technology. The image to the left shows a dual-gauge platform that was designed by the University of Iowa. A similar system using updated computing technology is current being developed by NASA.

Gauge Data

- TRMM gauge Data formats for **GAG, 2A56 & GMIN**
- GPM gauge Data formats for **GAG, 2A56 & GMIN**
- **Rain Rate Interpolation Algorithm**
- **TRMM gauge sites:**
Florida (KSC, SFL, STJ, KAM, KAP, KP2, NNN), Cal
- **GPM gauge sites:**
Nassawadox, Pocomoke, HalfDeg, WFF Assorted G (HyMeX, MC3E, IFloodS, IPHEX, OLYMPEX), Brazil

Please select a network first, then a year to download

- GAG NETWORK:

Please select a network first, then a year to download

- GMIN NETWORK:

Please select a network first, then a year to go to the

- 2A56 NETWORK:

Please select a network to get the sitelist.

- Sitelist NETWORK:

✓ NETWORK:

Florida

Kennedy (KSC)

South Florida WMD (SFL)

St. John's River WMD (STJ)

KAMP 2001 (KAM)

KAPP 2002 (KAP)

KAPP 2003-2004 (KP2)

Florida (NNN)

California

Eureka

☐ Texas

Harri

Kwaialein

KWA

Internat

Brazil (CEI)

Brazil (LBA)

Darwin (CSC)

France/Italy (

Wallops

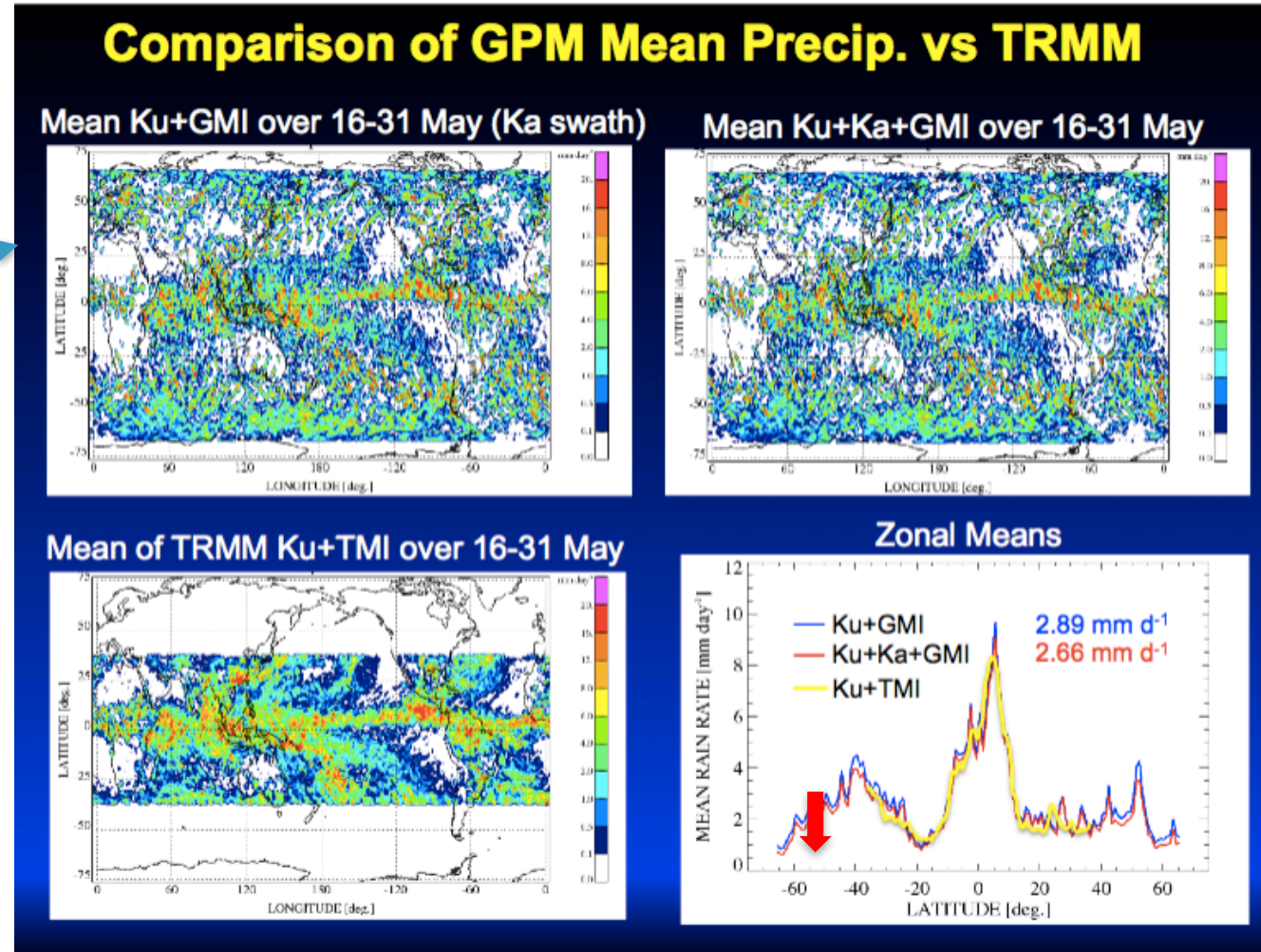
Nassawadox, VA

Wallops, VA (WFF Assorted Gauges)



GPM and TRMM Level-2 Data Product Comparison

Higher spatial resolution, coverage, and details in GPM products

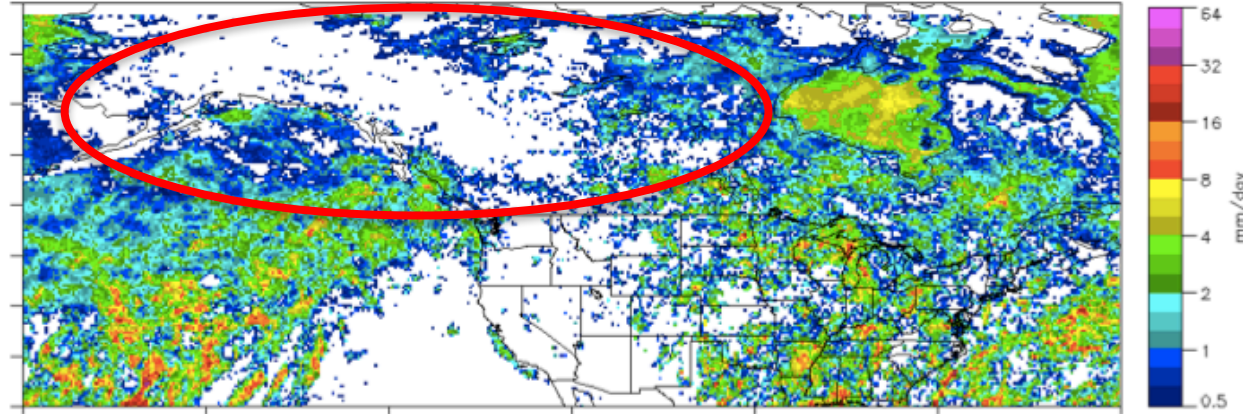


Courtesy: William Olson (PMM Investigator), NASA Mesoscale Atmospheric Processes

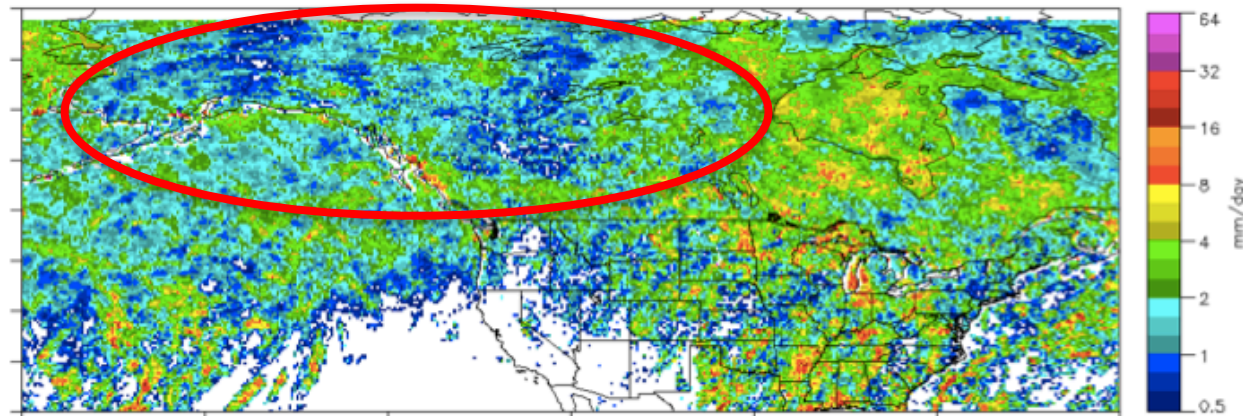


GPM and TRMM Level-2 Data Product Comparison

V1 (TRMM/NEXRAD based) Database



V2 (GPM based) Database



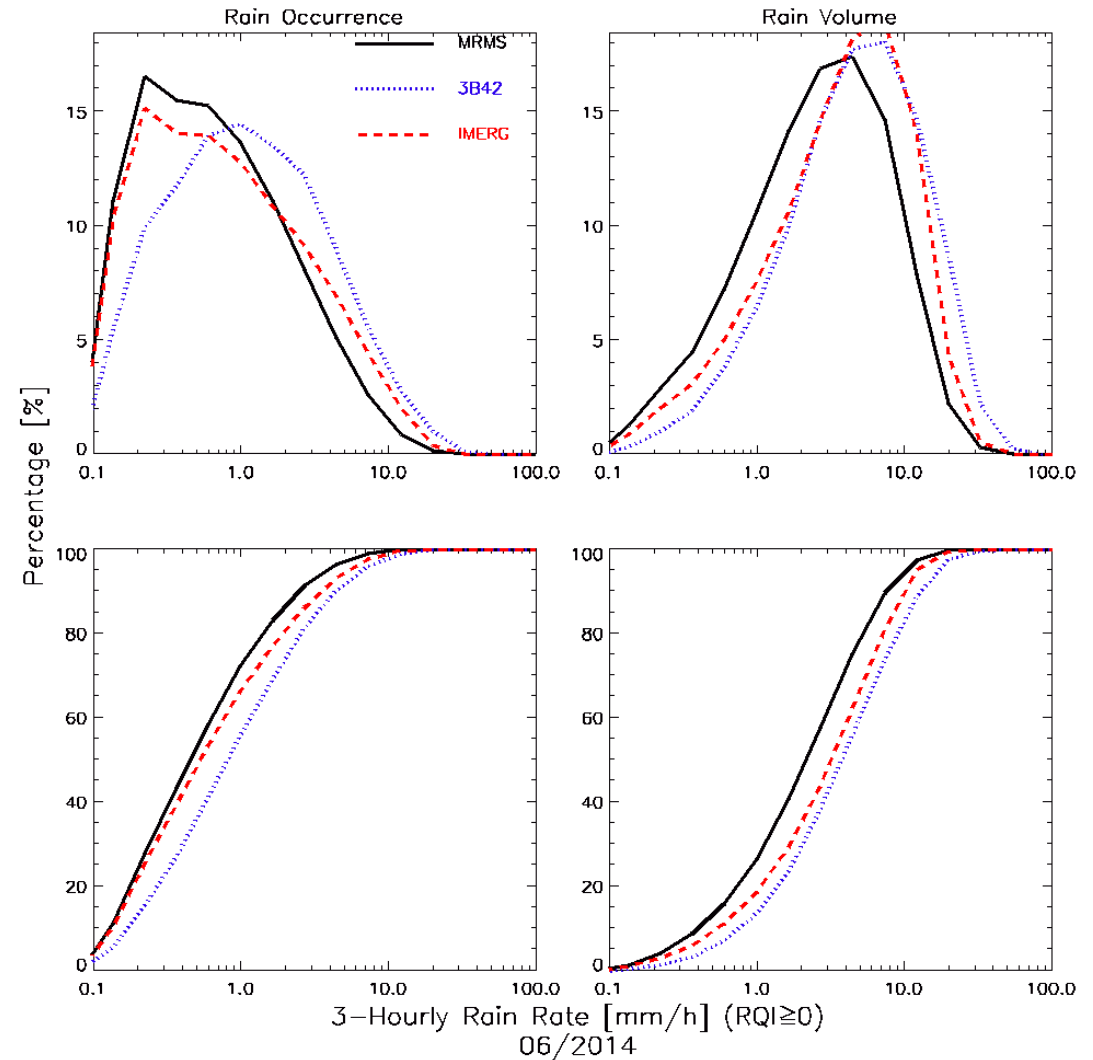
Improved
coverage in
GPM GMI
product

Courtesy: Christian Kummerow (PMM Investigator), Colorado State University



Validation – 3-hourly, 0.25° IMERG, 3B42, MRMS for June 15, 2014

- IMERG better than 3B42 for precipitation occurrence
- IMERG performs modestly better for precipitation volume
- Note: Original footprint GPROF retrievals below 0.1 mm/hr are thresholded to zero
- How this affects IMERG depends on the resolution of the input sensor and subsequent averaging (here 0.25°)

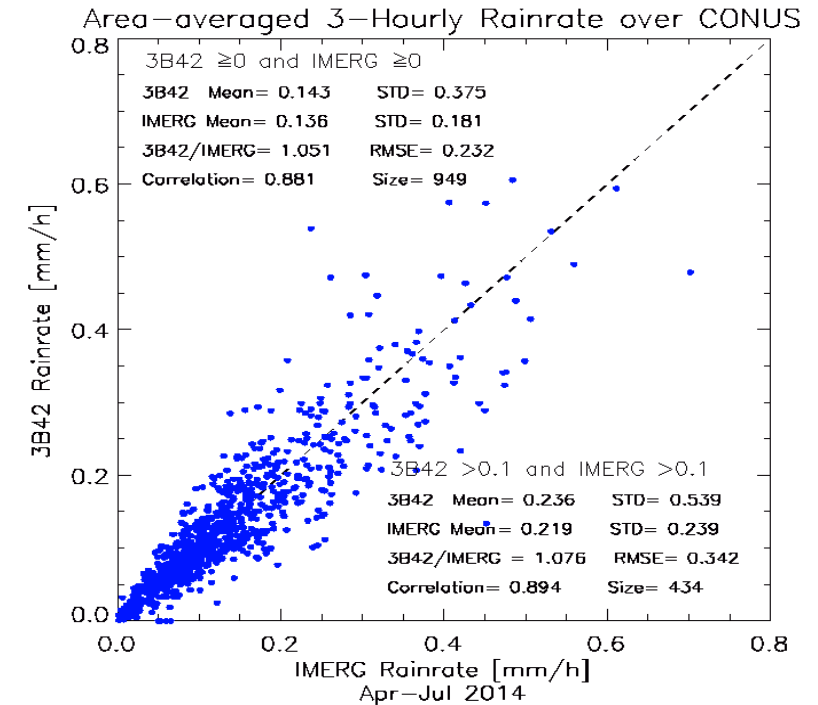
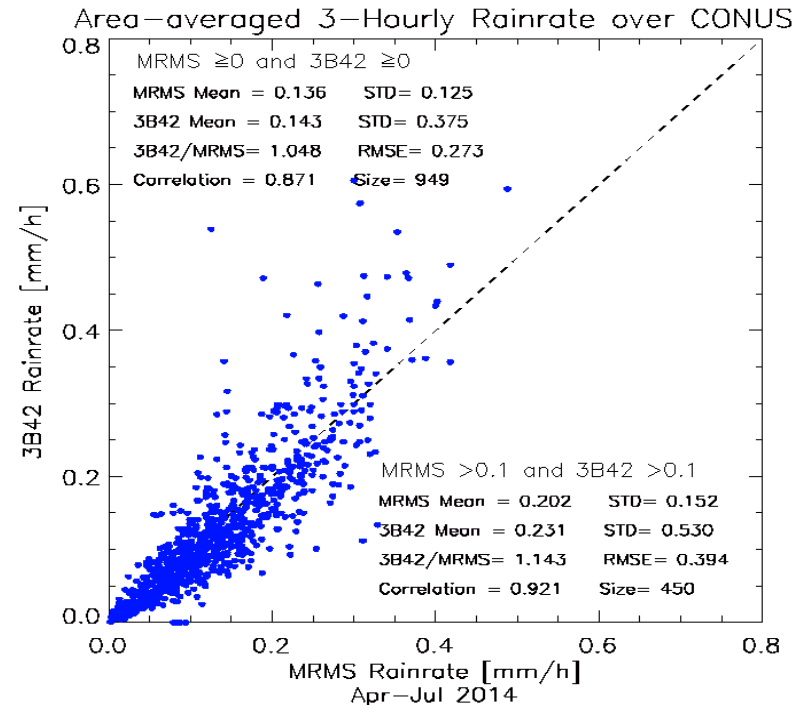
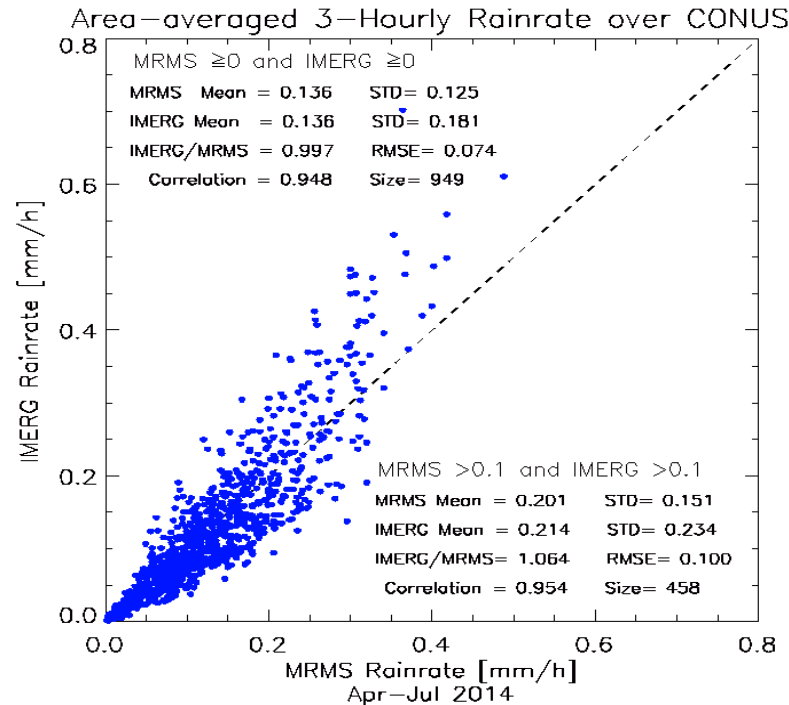


Slide Courtesy J. Wang (SSAI; NASA/GSFC 612)



Validation – 3-hourly, CONUS-avg. IMERG, 3B42, MRMS for April – July 2014

- IMERG better for bias and RMSE
- IMERG and 3B42 trend high at high rates
- At this spatial scale, error is roughly multiplicative

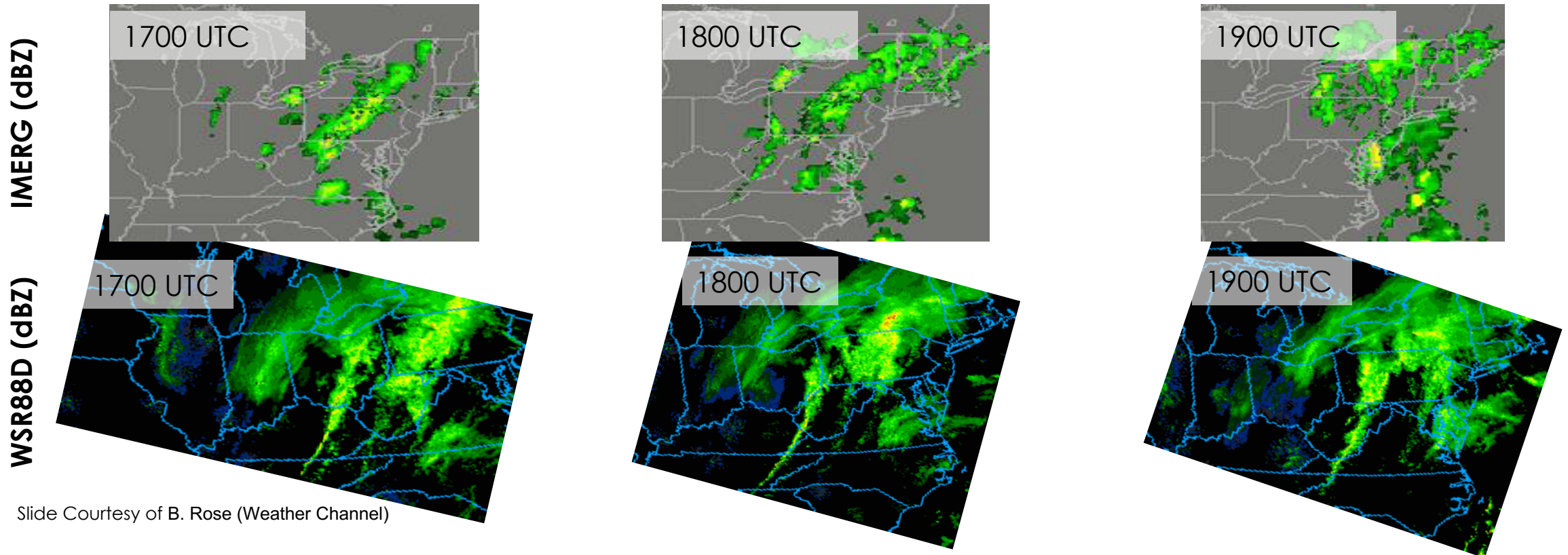


Slide Courtesy J. Wang (SSAI; NASA/GSFC 612)



Validation – Snow in IMERG, NWS WSR88D, 12 March 2014

- IMERG converted to dBZ, WSR88D in dBZ; both original resolution
- Hang-back line in radar missing in IMERG
- 2-5" of snow with near-blizzard conditions at Cleveland, Ohio, ~1900 UTC

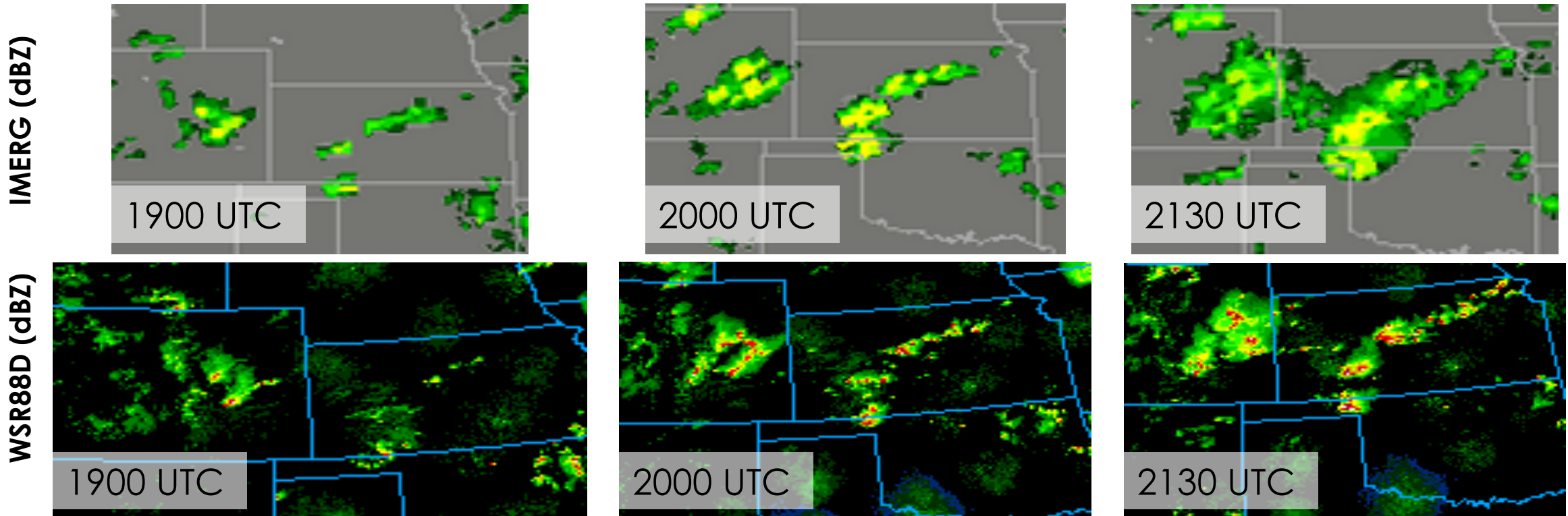


Slide Courtesy of B. Rose (Weather Channel)



Validation – Supercells in IMERG, NWS WSR88D, July 22, 2014

- IMERG converted to dBZ, WSR88D in dBZ; both original resolution
- IMERG has good placement of supercells
- Anvils more prominent in IMERG, lower maximum values (resolution?)

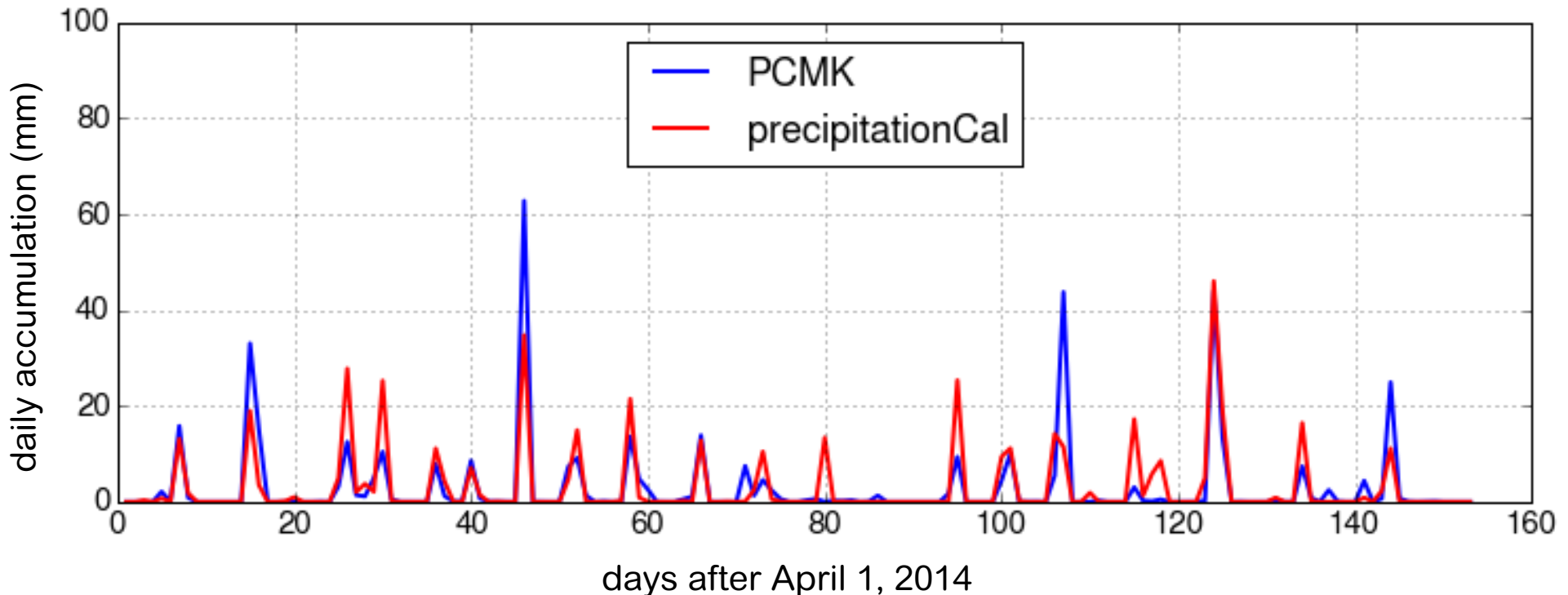


Slide Courtesy of B. Rose (Weather Channel)



Validation – Daily IERG and Pocomoke Fine-Scale Grid, April-Aug 2014

- 23 surface gauges in a 6x5 km near Wallops Island, Virginia
- Excellent correlation for most events (warm season)
- Both over- and under-estimates for largest events



Slide courtesy J. Tan (UMBC; WFF)

